6.0 EVALUATION OF REMEDIAL MEASURES

6.1 INTRODUCTION

Chemical data collected during the Remedial Investigation indicated that all media sampled, i.e, groundwater, surface water, surface soil, sediment, and subsurface soil were affected by inorganic and/or organic contaminants of concern. The purpose of this analysis is to focus on media where data exist in sufficient quantity and quality in which a basis for future remedial activity can be developed such as either an Interim Remedial Measure (IRM) or for use in a larger, more comprehensive feasibility study that would need to be performed following completion of site contaminant characterization. Specifically, surface soils, sediments, and surface water have been omitted from this analysis since the results of the Step I and Step I A-B Habitat Assessment shows the presence of contaminants exceeding applicable ecological benchmarks in the surface water and sediments of adjoining environments and that impacts may be occurring in the streams or wetland areas. As a result, further study in the wetlands area is required to determine if remedial measures are warranted. With regards to groundwater, data shows that on-site overburden wells exceed groundwater quality standards. However, no off-site overburden groundwater data are available as well as bedrock groundwater data. Conditions both on-site and off-site in the bedrock are unknown and therefore omitted. These data gaps will be further addressed in Section 7.0, Summary and Recommendations, which provides a path forward for additional data collection. As a result of the data limitations, this remedial measures screening analyses focuses on on-site overburden groundwater and subsurface soils.

6.2 REMEDIAL MEASURE OBJECTIVES

The development of remedial measure objectives requires specification of contaminants of concern (COCs) and media of interest. The contaminants of concern selected for the Magna Metals site with respect to on-site soils and overburden groundwater are based on the validity of the analytical results, frequency of occurrences and concentrations relative to background. COCs were presented in Section 4.0. Inorganic compounds were the most prevalent COCs. Organic compounds were less numerous in type, but exceeded NYSDEC Water Quality Standards/Guidance Value (Class GA) in two of the four monitoring wells.

Based on review of contaminant data, known conditions regarding site geology and comparison of data to NYSDEC Recommended Soil Clean-up Objectives and NYSDEC Water Quality Standards/Guidance Values (Class GA), it is determined that appropriate remedial measure objectives include the following:

- Restore contaminated subsurface soil in the leach pit/holding tank area to pre-existing manufacturing operating conditions (assumed as background) or to the maximum extent practical.

- Contain contaminated overburden groundwater in the leach pit/holding tank area from migrating off-site or to the maximum extent practical.

To fully address the remedial measure objectives developed for this site, no action, limited action, and actions consisting of containment, treatment and/or disposal were considered. The no action alternative involves no treatment but would implement reviews for periodic reevaluation of site conditions. Limited Action categories involve measures that restrict access to contaminated areas and the use of contaminated groundwater, and include long term monitoring. Containment actions include technologies that involve little or no treatment, but provide protection of the environment by reducing the mobility of contaminants and risks of exposure. Containment actions consist of covering contaminated areas and controlling groundwater movement through the use of low permeability barriers, containment walls, or extraction systems. Treatment actions include technologies to reduce the volume and/or toxicity of contaminants. These technologies include pumping, excavation, treatment (physical, chemical, or geological) and disposal technologies.

6.3 IDENTIFICATION AND SCREENING OF REMEDIAL MEASURE TECHNOLOGY TYPES AND PROCESS OPTIONS

The remedial measure technology types associated with each of the general actions typically considered for the cleanup of contaminated soil and groundwater were based on the following documents: Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Technology Screening Guide for Treatment of CERCLA Soils and Sludges, Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites, and the Handbook for Remedial Action at Waste Disposal Sites, as well as experience on other hazardous waste projects, knowledge of new technologies, and the professional judgment in performing feasibility assessments. Most of these remedial technology types contain several different process options that could apply to the contaminated soil and groundwater. These potentially applicable technology types and process options are screened based on technical implementability and effectiveness considering site-specific conditions, and contaminant types.

In the following tables, potential technologies for remediation of the inorganic and organic-contaminated soils and groundwater are briefly described and summarized with the results of the screening and evaluation. For those technologies which were not retained for further evaluation, the rationale for their elimination is included. The screening evaluations for each identified technology are summarized in Tables 6-1 and 6-3. The evaluation and selection of process options for soil and groundwater technologies are presented in Tables 6-2 and 6-4.

6.4 SELECTION OF CRITERION OF REMEDIAL MEASURES

The remedial measure options presented in Tables 6-1 and 6-3 for on-site soils and groundwater were assessed using a streamlined and focused evaluation approach, considering the general criteria of effectiveness, implementability and cost. A discussion of these criterion follows:

TABLE 6-1 (Sheet 1 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF SOIL REMEDIAL MEASURES

Remedial Measures	Remedial Measure Categories	Description	Technically Feasible	Screening Comments
1. No Action	o Site Reviews			
	. Five-year reviews	The site and available data are reviewed to determine if remedial action is needed.	X	Provides baseline against which other remedial technologies can be compared. Required for consideration by NCP.
2. Limited Action (Institutional Controls)	o Monitoring			
	. Monitor and analyze soil, groundwater and sediment	Samples are collected and analyzed for contaminants and migration of contaminants is assessed.	X	Provides baseline against which other remedial technologies can be compared. Required for consideration by NCP.
	o Public Awareness . Post warning signs, inform local officials and hold public meetings, etc.	Community relation activities are performed	X	Required for effective implementation of Limited Action.
	o Restrict Access/Use			
	. Access Restrictions (fence)	Access restricted by fencing the contaminated area.	X	Required for effective implementation of Limited Action.
	. Deed Restrictions	Land use restrictions would be specified in the real estate transactions of the property.	X	Required for effective implementation of Limited Action.
3. Containment	o Capping			
	. Soil Cap	Contaminated soil is covered with clean soil layer		Will not meet RCRA requirements and will not prevent infiltration of surface water.
	. Clay cap	Contaminated soil is covered with low permeability clay layer		Will not meet RCRA requirements. Containment of contaminated soils cannot effectively prevent migration of contaminants since groundwater may enter the containment area from upgradient locations.

X Indicates that option is technically feasible.

TABLE 6-1 (Sheet 2 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF SOIL REMEDIAL MEASURES

Remedial Measures	Remedial Measure Categories	Description	Technically Feasible	Screening Comment
	. Synthetic membranes	Synthetic membranes are thin flexible membranes made of PVC, rubber, etc. used to cover contaminated soil		Same as clay cap
	. Chemical sealants	Chemical sealants are stabilizers and cements are added to top soil to create stronger and less permeable surface seal.		Same as clay cap
	. Multimedia cap	Multimedia cap is a combination of two or more single layer caps to cover contaminated soil.		Will meet RCRA requirements, and has fewer limitations than other capping options regarding groundwater contamination; will not prevent leaching of contaminants into bedrock.
4. Removal	o Removal			
	. Excavation	Excavation involves removing contaminated soil using backhoes, bulldozers, front end loaders,	X	Required component of many potential process options.
5. Treatment	o Thermal Treatment			
	. Incineration	Incineration is a thermal destruction method for all forms of organnic contamination involving treatment at high temperatures.		Not feasible for inorganic contaminants of concern
	. Wet oxidation	Wet oxidation process involves oxidizing pumpable aqueous organics at elevated temperatures and pressures.		Not feasible for inorganic contaminants; does not handle soils which can't be pumped.
	. Thermal desorption	Thermal desorption is a thermal (400EF to 900EF) stripping process which promotes volatilization of organics from soil to air.		Not feasible for inorganics.

TABLE 6-1 (Sheet 3 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF SOIL REMEDIAL MEASURES

Remedial Measures	Remedial Technology Categories	Description	Technically Feasible	Screening Comments
	o Chemical Treatment			
	. Alkali metal dechlorination	Alkali metal dechlorination utilizes polyethylene glycol and alkali solution (APEG) to detoxify some chlorinated organics in the contaminated soils		Developed and demonstrated for PCBs-contaminated soil; not feasible for soil contaminated with inorganics.
	. Soil washing and extraction	Soil washing and extraction technology involves the extraction of inorganic and organic contaminants from the soils using solvents, surfactants, chelating agents, etc.		Not feasible with significant silt/or clay content.
	. Supercritical Fluid Extraction	Supercritical extraction is based on the use of certain gases (CO_2 or Propane), which have excellent dissolving characteristics when heated and compressed to or near their critical point, to remove organics from soil. Typical system operates at 70EF to 100EF and 150 to 3000 psi.		Not feasible for inorganic contamination or soils which cannot be pumped.
	. Stabilization	Fixation is a chemical process whereby contaminated soils are converted into a stable cement type matrix in which contaminants are bound and become immobile.	X	Feasible for inorganic contamination in soils.

X Indicates that option is technically feasible

TABLE 6-1 (Sheet 5 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF SOIL REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
	. In Situ Volatilization	In situ volatilization is a process in which air is pumped through vadose zone soils or a vacuum is applied to enhance the vaporization of volatile organics from contaminated soil to the air.		Not feasible to implement at site in presence of site specific limiting conditions including low permeability soil and complex geological conditions; not applicable for inorganics.
	o Vapor Phase Volatile Emission Control			
	. Vapor Phase Carbon Adsorption	Carbon adsorption is a process in which contaminants present in the vapor phase will be adsorbed to the carbon granules for final destruction or disposal of contaminants.	X	Feasible for treating vapor phase contaminants resulting from other soil treatment process options.
	. Afterburner (Incineration)	Incineration is a thermal destruction process for contaminants present in the gaseous vapor phase used in emission control.	X	Feasible for treating vapor phase contaminants resulting from other soil treatment process options.
	. Catalytic Oxidation	Gaseous vapor is oxidized in the presence of a catalyst	X	Feasible for treating vapor phase contaminants resulting from other soil treatment process options.
6. Disposal	o Transportation Technologies			
	. Trucks	Trucks can be used to bring equipment and materials to the site and to transport soil.	X	Potentially feasible for off-site transportation of excavated soils.
	. Trains	Trains can be used to bring equipment and materials to the site and to transport soil and rubbles.		Not feasible due to non-existence of rail connection to the site and treatment and disposal facilities.

X Indicates that option is technically feasible

TABLE 6-1 (Sheet 6 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF SOIL REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
	o Disposal Technologies			
	. Construction of an on-site RCRA landfill	A new RCRA landfill facility can be constructed within the site boundary for disposal of contaminated soil.		Not feasible due to restrictive site conditions (site usage, wetlands, floodplains, site boundaries).
	. Existing off-site RCRA landfill	The contaminated soil or waste would be hauled to an existing RCRA landfill which is already permitted to accept hazardous material.	X	Feasible for disposal of treated soils.
	. On-site nonhazardous landfill	The treated soil would be redeposited on-site.	X	Potentially feasible
	. Off-site nonhazardous landfill	The treated soil can be hauled to an existing landfill which is already permitted to accept.	X	Feasible for disposal of treated soils.

X Indicates that option is technically feasible

TABLE 6-2 (Sheet 1 of 2)

MAGNA METALS SITE
EVALUATION OF PROCESS OPTIONS FOR SOIL

Remedial Measures	Remedial Measures Process Options	Effectiveness	Implementability	Cost
1. No Action	o Site Reviews . Five-year reviews	- Useful for documenting conditions - Reduction in volume and toxicity of contaminated groundwater left to natural attenuation	- Easily implemented	Low cost, No Operating and Maintenance (O&M), Low periodic cost for reviews
2. Limited Action (Institutional Controls)	o Monitoring . Monitor and analyze groundwater and sediment	- Useful for documenting conditions - Reduction in volume and toxicity of contaminated groundwater left to natural attenuation	- Easily implemented	Low cost, low Operating and Maintenance (O&M)
	o Public Awareness . Post warning signs, inform local officials, hold public meetings, etc.	- Does not actively reduce contamination - Keeps the community involved with issues	- Easily implemented - Public participation required	Low cost, low O&M
	o Restricted Access . Access restrictions (fence)	- Prevents direct contact with the soil, but does not actively reduce contamination	- Easily implemented	Low cost, low O&M
	. Deed restrictions	- Effectiveness depends on continued future implementation - Reduces risks to humans, but does not actively reduce contamination	- Easily implemented	Low cost, low O&M
4. Removal	o Removal . Excavation	- Effective at removing contaminated soil - Will not reduce volume or toxicity of contaminated soil and require subsequent treatment/disposal - Will cause volatilization	- Easily implemented	Moderate cost, no O&M
5. Treatment	o Chemical Treatment			
	. Stabilization	- Stabilization is effective for immobilization of semivolatile and metal contaminants.	- Easily implemented	High cost, no O&M

TABLE 6-2 (Sheet 2 of 2)

MAGNA METALS SITE
EVALUATION OF PROCESS OPTIONS FOR SOIL

Remedial Measures	Remedial Measures Process Options	Effectiveness	Implementability	Cost
	o Vapor Phase Volatile Emission Control . Carbon Adsorption	- Effective in removing vapor phase contaminants - Needs regeneration or final disposal of spent carbon	- Easily implemented	High cost, high O&M
	. Afterburner	- Destroys contaminants in the vapor phase	- Easily implemented	Very high cost, high O&M
	. Catalytic Oxidation	- Destroys organic contaminants in the vapor phase	- Easily implemented	Very high cost, high O&M
6. Disposal	o Transportation Technologies . Trucks	- Effective for transportation	- Easily implemented	Low cost, no O&M
	o Disposal Technologies . Existing off-site RCRA landfill*	- Removes contaminated or treated soil from the site	- Easy to locate	Moderate cost
	. On-Site Landfill	- Effective for on-site redeposition and grading	- Easily implemented	Low cost, low O&M
	. Off-Site Landfill	- Removes contaminated or treated soil from the site	- Easy to locate	Lump cost

TABLE 6-3 (Sheet 1 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF GROUNDWATER REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
1. No Action	o Site Reviews			
	. Five-year reviews	The site and available data are reviewed to determine if remedial action is needed	X	Provides baseline against which other remedial technologies can be compared. Required for consideration by NCP.
2. Limited Action (Institutional Controls)	o Monitoring			
	. Monitor and analyze groundwater	Samples are collected and analyzed for contaminants and migration of contaminants is assessed	X	Provides baseline against which other remedial technologies can be compared. Required for consideration by NCP.
	o Public Awareness . Post warning signs, inform local officials and hold public meetings, etc.	Community relation activities are performed	X	Required for effective implementation of Limited Action.
	o Restrict Access/Use			
	. Well Permit Requirements	Restrict or regulate the placement of new wells and continued use of existing wells at and around the Site.	X	The overburden groundwater movement may migrate off-site or into bedrock aquifer.
3. Containment	o Barriers			
	. Sheet piling	Sheet piling is driven into soil and can be used as barrier to limit the spread of contaminants.		May not be applicable due to potential pathway to underlying bedrock.
	. Slurry walls	Slurry walls are constructed in vertical trench excavated under bentonite slurry.		May not be applicable due to potential pathway to underlying bedrock.

X Indicates that option is technically feasible

TABLE 6-3 (Sheet 2 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF GROUNDWATER REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
	. Grout curtains	Grouting consists of injecting fluids into soil mass, which set in place, reduce water flow, and strengthen the formation.		May not be applicable due to potential pathway to bedrock layer.
	. Bottom sealing	Bottom sealing is used to place a horizontal barrier beneath site to act as a floor to prevent downward migration of contaminants		Technology not adequately developed for application.
	. Groundwater Interception	Groundwater interception involves active manipulation and management of groundwater in order to prevent formation/and or contained dispersion of a plume.	X	A trench or wells can be installed to collect groundwater in the overburden aquifer.
4. Extraction				
	o Extraction Technologies			
	. Dewatering	Dewatering is a physical unit operation to reduce moisture content in order to facilitate excavation, treatment, and disposal of soils	X	Required component of many potential process options.
	. Pumping	Groundwater pumping and collection technologies involve extraction of contaminated groundwater for subsequent treatment and prevention of downgradient migration.	X	Potentially applicable for interception and recovery of contaminant plume in overburden aquifer.

X Indicates that option is technically feasible

TABLE 6-3 (Sheet 3 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF GROUNDWATER REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
5. Treatment				
	o Chemical Treatment			
	. Neutralization/pH Adjustment	Neutralization is a chemical process in which acids and alkalies are neutralized to eliminate or reduce their reactivity and corrosiveness. pH adjustment may also be used to optimize other treatment processes.	X	Feasible for metals removal. Potentially required to optimize other treatment processes.
	. Chemical Precipitaton	Chemical precipitation is a pretreatment process in which acid or base is added to the contaminated water to adjust the pH to the point where the lowest solubility of the compounds to be removed is reached. Other precipitants such as sodium sulfide or ferric chloride may be added to precipitate certain metals out of solution.	X	Potentially feasibile for metals removal.
	. Ion Exchange	Ion exchange is a chemical process in which selected contaminant ions in the aqueous phase are exchanged for inocuous ions in a fixed bed ion exchanger or counter-current exchanger.	X	Potentially feasible for metals removal.
	. UV-Chemical Oxidation	When catalyzed by ultraviolet light, a strong oxidant, such as hydrogen peroxide or ozone, reforms into hydroxyl radicals (strong oxidizer) which oxidize the organic contaminants in the groundwater to CO_2 and water.	X	Feasible for treatment of organic contaminants in site groundwater.
	o Physical Treatment			
	. Flocculation	Flocculation is a process to promote agglomeration and settling of suspended solids.	X	Potentially feasible for metals removal.

X Indicates that option is technically feasible

TABLE 6-3 (Sheet 4 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF GROUNDWATER REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
	. Clarification	Clarification is a gravity settling process which allows heavier solids to collect at the bottom of a containment vessel leaving clear liquid at the top.	X	Potentially feasible for metals removal.
	. Filtration	Filtration is a process of separating suspended and colloidal solids from a liquid mixture through a porous medium	X	Potentially feasible for suspended solids and metals removal.
	. Air Stripping	Air stripping is a mass transfer process in which volatile organic contaminants in groundwater are transferred to gaseous (vapor) phase.	X	Effectively removes volatile contaminants.
	. Steam Stripping	Steam stripping is a mass transfer process which uses steam to evaporate volatile organics from aqueous wastes into the gaseous (vapor) phase.	X	Feasible for treatment of volatile organics and some semivolatile organics in site groundwater.
	. Carbon Adsorption	Carbon adsorption is a process in which the organic contaminants in water are adsorbed onto activated carbon granules.	X	Feasible for treatment of organics in site groundwater.
	o Biological			
	. Aerobic	Aerobic treatment involves the use of native microbes or selectively adopted bacteria to degrade a variety of organic compounds under aerobic conditions.		Not feasible due to low levels and mix of contaminants at the site.
	. Anaerobic	Anaerobic treatment is similar to aerobic treatment but takes place in the absence of oxygen.		Not feasible due to low levels and mix of contaminants at the site.

X Indicates that option is technically feasible

TABLE 6-3 (Sheet 5 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF GROUNDWATER REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
6. Source Control				
	o Removal			
	. Excavation	Contaminated soils are excavated to prevent further leaching of contaminants from the	X	This technology is feasible for eliminating the contaminant source to groundwater and allowing
for		soil into the groundwater.		a more rapid groundwater cleanup.
	o Treatment			
	. Thermal Treatment	See Table 6-1	X	Several thermal treatment processes can be used to remove organic contamination from the excavated soils.
	. Physical Treatment	See Table 6-1	X	Mechanical aeration may be used to remove VOCs from excavated soils.
	. Biological Treatment	See Table 6-1	X	Not feasible for low level and mix of contaminants in excavated soils.
	. Chemical Treatment	See Table 6-1	X	Stabilization of the excavated soils is feasible to allow on-site disposal while eliminating the potential for leaching contaminants to the groundwater.
	. In Situ Treatment	See Table 6-1		See Table 2-4
7. Disposal				
	o Disposal Technologies			
	. POTW	Extracted groundwater would be pumped to publicly owned treatment works for treatment and disposal.		Not feasible because a POTW is not capable of removing organic contaminants in site groundwater.

X Indicates that option is technically feasible

TABLE 6-3 (Sheet 6 of 6)

MAGNA METALS SITE
INITIAL SCREENING OF GROUNDWATER REMEDIAL MEASURES

Remedial Measures	Remedial Measures Categories	Description	Technically Feasible	Screening Comments
	. TSD facility	Extracted groundwater would be transported to a commercial facility for treatment, storage and disposal.	X	Potentially feasible for short-term disposal prior to treatment plant construction.
	. Surface Water	Extracted groundwater would be discharged to on-site surface water after treatment to appropriate levels.	X	Potentially feasible for disposal of groundwater.

X Indicates that option is technically feasible

TABLE 6-4 (Sheet 1 of 3)

MAGNA METALS SITE
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER

Remedial Measures	Remedial Measures Categories and Process Options	Effectiveness	Implementability	Cost
1. No Action	o Site Reviews* . Five-year reviews*	- Useful for documenting conditions - Reduction in volume and toxicity of contaminated groundwater left to natural attenuation	- Easily implemented	Low cost, no Operating and Maintenance (O&M), low periodic cost for reviews
2. Limited Action (Institutional Controls)	o Monitoring* . Monitor and analyze groundwater and sediment*	- Useful for documenting conditions - Reduction in volume and toxicity of contaminated groundwater left to natural attenuation	- Easily implemented	Low cost, low Operating and Maintenance (O&M)
	o Public Awareness*			
	. Post warning signs, inform local officials, hold public meetings, etc.*	- Does not achieve remediation objectives - Keeps the community involved with issues	- Easily implemented - Public participation required	Low cost, low O&M
	o Restrict Access/Use*			
	. Well Permit Requirements*	- Controls current and future use of groundwater - Does not provide treatment	- Easily implemented	Low cost, low O&M
3. Containment	o Barriers*			
	. Groundwater Interception*	- Effectively stops migration of contaminant plume - Allows treatment of contaminated groundwater in overburden aquifer	- Easily implemented	Moderate cost, low O&M
4. Extraction	o Extraction . Dewatering*	- Effectively dewaters soil for subsequent treatment - Support technology-not intended to treat the waste.	- Easily implemented	Moderate cost, no O&M
	. Pumping*	- Effective in extracting contaminated groundwater - Reduces mobility of contaminants	- Easily implemented - Requires continuous maintenance	Moderate cost, moderate O&M

* Technology and process options retained.

TABLE 6-4 (Sheet 2 of 3)

MAGNA METALS SITE
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER

Remedial Measures	Remedial Measures Categories and Process Options	Effectiveness	Implementability	Cost
5. Treatment	o Chemical Treatment			
	. Neutralization/pH Adjustment*	- Effective in optimizing other treatment processes and also neutralizing treated groundwater	- Easily implemented	Low cost, high O&M
	. Chemical Precipitation*	- Effective in precipitating suspend solids and metals contaminants from groundwater	- Easily implemented	Moderate cost, high O&M
	. Ion Exchange*	- Effective in removing low-level metal contamination - Aqueous specific resin and disposal of resins.	- Easily implemented	High cost, high O&M
	. UV-Chemical Oxidation*	- Effective in oxidizing organic contaminants	- Easily implemented - Requires skilled labor - High power requirement	High cost, high O&M
	o Physical Treatment			
	. Flocculation*	- Effective in flocculating chemical precipitants	- Easily implemented	Low cost, moderate O&M
	. Clarification*	- Effective in separating suspended particles from liquid phase	- Easily implemented	Moderate cost, low O&M
	. Filtration*	- Effective in separating less settlable solids from liquid phase	- Easily implemented	Moderate cost, moderate O&M
	. Air Stripping*	- Effective at removing volatile contaminants - Requires vapor phase air pollution control.	- Easily implemented	Moderate cost, moderate O&M
	. Steam Stripping*	- Effective at removing volatiles and some semivolatiles - Requires vapor phase air pollution control	- Easily implemented	High cost, high O&M

*Technology and process options retained.

TABLE 6-4 (Sheet 3 of 3)

MAGNA METALS SITE
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER

Remedial Measures	Remedial Measures Categories and Process Options	Effectiveness	Implementability	Cost
	. Carbon Adsorption*	- Effective in removing organics - Needs regeneration or disposal of spent carbon	- Easily implemented	Moderate cost, high O&M
6. Source Control				
	o Removal			
	. Excavation*	- Effective for removal of contaminated source materials	- Easily implemented	Moderate cost, no O&M
	o Treatment			
	. Thermal Treatment*	- Effective for removal of organic contaminants - Off-gas air pollution control required	- Easily implemented	Moderate cost, high O&M
	. Physical Treatment	- Effective for removal of VOCs - Off-gas air pollution control required	- Easily implemented	Moderate cost, low O&M
	. Chemical Treatment*	- Effective for immobilization of SVOCs and inorganics	- Easily implemented	Low capital, High O&M
7. Disposal				
	o Technologies Disposal . TSD Facility*	- Effective for disposal of extracted groundwater during dewatering to facilitate excavation	- Easily implemented	Moderate cost
	. Surface Water*	- Effective for disposal of treated groundwater	- Easily implemented	Low cost, low O&M

* Technology and process options retained.

Effectiveness

A key aspect of the screening evaluation is the effectiveness of each alternative in protecting human health and the environment by achieving the action levels specified for the various media of concern. Alternatives are evaluated as to the protectiveness they will provide and the reductions in toxicity, mobility or volume it would achieve. Both short- and long-term components of protectiveness are also evaluated, short-term referring to the construction and implementation period, and long-term referring to the period after the remedial action is complete. Reduction of toxicity, mobility or volume refers to changes in one or more characteristics of the hazardous substances or contaminated media by the use of treatment that decreases the potential threats or risks associated with the hazardous material.

Implementability

Implementability, as a measure of both the technical and administrative feasibility of constructing, operating and maintaining a remedial measure alternative, is used during screening to evaluate the combinations of process options with respect to conditions at a specific site. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial measure is complete; it also includes operation, maintenance, replacement and monitoring of technical components of an alternative, if required, into the future after the remedial measure is complete. Administrative feasibility refers to the ability to obtain approvals from other offices and agencies, the availability of treatment, storage, and disposal services and capacity, and the requirements for, and availability of, specific equipment and technical specialists.

Determinations of not technically feasible or not available will often preclude an alternative from further consideration unless steps can be taken to change the conditions responsible for the determination. Often, this type of fatal flaw would have been identified during technology screening, and the alternative would not have been assembled. Negative factors affecting administrative feasibility will normally involve coordination steps to lessen the negative aspects of the alternative but will not necessarily eliminate an alternative from consideration.

Cost

Typically, alternatives will have been defined well enough before screening that some estimates of cost are available for comparisons among alternatives. However, a general comparative analysis can be performed using the broad range of low, moderate, or high costs.

Based on the above analysis of effectiveness, implementability, and costs, the selected alternatives for further evaluation for on-site soils and groundwater are: removal, excavation, disposal and containment/ groundwater interception.

6.5 ANALYSIS OF RECOMMENDED REMEDIAL MEASURES

In order to meet the intent of CERCLA requirements, the following evaluation criteria have been developed. These criteria are discussed and defined in the USEPA Guidance for Conducting RI/FS under CERCLA.

The criteria used in this detailed analysis include:

1. Short-Term Effectiveness
2. Long-Term Effectiveness
3. Reduction of Toxicity, Mobility and Volume
4. Implementability
5. Cost
6. Overall Protection of Human Health and the Environment

Short-Term Effectiveness

This evaluation criterion addresses the impacts of the action during the construction and implementation phase until the remedial measures objectives have been met. Factors to be evaluated include protection of the community during the remedial measures, protection of workers during the remedial measures, environmental impacts resulting from the implementation of the remedial measures, and the time required to achieve protection.

Long-Term Effectiveness

This evaluation criterion addresses the results of the remedial measures in terms of the potential risk remaining at the site after the objectives have been met. The components of this criterion include the magnitude of the remaining risks measured by numerical standards such as action levels and the long-term reliability of management controls for providing continued protection from residuals; i.e., the assessment of potential failure of the technical components.

Reduction of Toxicity, Mobility or Volume

This evaluation criterion addresses the statutory preference that treatment is used to result in the reduction of principal threats of the total mass of toxic contaminants, the irreversible reduction in contaminant mobility, or the reduction of the total volume of contaminated media. Factors to be evaluated in this criterion include the treatment process employed; the amount of hazardous material destroyed or treated; the degree of reduction in toxicity, mobility or volume expected; and the type and quantity of treatment residuals.

Implementability

This criterion addresses the technical and administrative feasibility of implementing a remedial action and the availability of various services and materials required during its implementation. *Technical feasibility* factors include construction and operation difficulties, reliability of technology, ease of undertaking additional remedial measures, and the ability to monitor the effectiveness of the remedy. *Administrative feasibility* includes the ability and time required for permit approval and for activities needed to coordinate with other agencies. Factors employed in evaluating the *availability of services and materials* include availability of treatment, storage, and disposal services with required capacities; availability of equipment and specialists; and availability of prospective technologies for competitive bid.

Cost

The types of costs that would be addressed include: capital costs, operation and maintenance (O&M) costs, costs of five-year reviews where required, and present value of capital and O&M costs. Capital costs consist of direct and indirect costs. Direct costs include expenditures for the equipment, labor, and materials necessary to install remedial actions. Indirect costs include expenditures for engineering, financial, and other services required to complete the installation of remedial alternatives. Annual O&M costs include auxiliary materials and energy, disposal of residues, purchased services, administrative costs, insurance, taxes, license costs, maintenance reserve and contingency funds, rehabilitation costs, and costs for periodic site review.

This assessment evaluates the costs of the remedial actions on the basis of present worth. Present worth analysis allows remedial measures to be compared on the basis of a single cost representing an amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A required operating performance period is assumed for present worth and is a function of the discount rate and time. A discount rate of seven percent is assumed for a base calculation. The "study estimate" costs provided for the remedial actions are intended to reflect actual costs with an accuracy of -30 to +50 percent.

Overall Protection of Human Health and the Environment

This evaluation criterion provides an overall assessment of protection based on a composite of factors such as long-term and short-term effectiveness and compliance with ARARs. Evaluations of the overall protectiveness address:

- How well a specific site remedial action achieves protection over time; and

- How well each source of contamination is to be eliminated, reduced, or controlled for each remedial alternative.

Removal/Excavation/Off-Site Disposal

This alternative consists of excavation and removal of contaminated soils (approximately 580 cy), stabilization and off-site disposal of the soil. Excavation refers to the use of construction equipment such as backhoes, bulldozers, front end loaders that are typically used on land to excavate and handle contaminated soil. Transportation includes the use of trucks, which can be used to deliver equipment and materials for remediation. Trucks will be properly decontaminated, weighed, and manifested before leaving the site. Regulations regarding hauling hazardous, nonhazardous materials, and oversized and heavy loads over public roads will be taken into consideration. Truck transportation is flexible, as the number of trucks can be increased or decreased depending upon project requirements. This mode of transportation does not require special loading facilities at the site or unloading facilities at the destination. Should material be hazardous, contaminated soil would be hauled to an existing RCRA Subtitle C landfill facility which is permitted to accept hazardous wastes. Hazardous material would also require treatment to meet land disposal restrictions. This assessment assumes that all excavated materials can be disposed of at a non-hazardous landfill. The area and volume of soil is estimated to be five feet out from each pit on all sides and also to have an estimated depth of 10 feet (i.e., top of the water table). A berm would be constructed at the perimeter of the excavation to prevent erosion and to mitigate any potential impacts to the nearby wetlands area. After refilling the excavated area with clean backfill, the surface would then be graded, covered with topsoil and seeded. During excavation, a security fence will be installed around the area and the site.

Removal/Excavation/Off-Site Disposal

Short Term Effectiveness: The potential public health threats to workers and area residents would include direct contact with contaminated soils and inhalation of fugitive dust and organic vapors generated during excavation and soil handling. The area would be secured using a fence and access would be restricted to authorized personnel only. Dust control measures such as wind screens and water sprays would be used to minimize fugitive dust emission resulting from excavation. Air monitoring for particulates and organic vapors would be conducted throughout the site remediation activities.

The risk to workers would be minimized by the use of adequate preventive measures such as enclosed cabs on backhoes and proper personal protection equipment to prevent direct contact with contaminated soil and inhalation of fugitive dust and volatile organics. All site activities would be in accordance with a site-specific health and safety plan. Short-term impacts on the environment resulting from removal of vegetation and destruction of habitat in the soil would be minimal since the plant area has minimal vegetation. Impacts would be temporary and would be mitigated by restoring the remediated area. Erosion and sediment control measures such as silt curtains would be provided during excavation activities to control migration of contaminated soil and sediment.

The short-term impacts on the environment would be due to an increase in traffic and noise pollution resulting from hauling of excavated soil to off-site treatment facilities and bringing new soil in for fill. Transportation of excavated soil may introduce short-term risks with the possibility of spillage along the transport route. A traffic control plan developed with the assistance of local authorities would be implemented to minimize potential traffic problems.

A total period of 12 months is estimated for this remedial measure for design, bidding, selecting a contractor, procurement of off-site disposal facilities, and excavation of soil. The actual excavation period is estimated to be three months.

Long-Term Effectiveness: The excavation and removal of contaminated soil from the site would reduce the and the leaching of contaminants into groundwater. Excavated soil would be replaced by clean soil. Following remediation, the contaminated area would be restored and the site would not require any further maintenance or monitoring.

Reduction of Toxicity, Mobility or Volume: Excavation and off-site stabilization constitute a treatment which would result in a permanent remedy. Inorganic contaminants in the soil will be immobilized and disposed of in a controlled off-site landfill. Hence this treatment alternative would completely eliminate the toxicity, mobility and volume of contaminants at the site.

Implementability:

Technical Feasibility

All the components of this remedial measure are well developed and commercially available. The contaminated soils would have to undergo a series of analyses prior to acceptance for treatment at the off-site facility. Land is available at the site for staging excavation and transportation. Excavation, transportation, and restoration can be performed with limited difficulty.

Administrative Feasibility

Implementation of this measure would require public access restriction to the site during the remediation process. Contractual procurement of disposal facilities to handle the type and volume of soil on site would be required. Coordination with state and local agencies would also be required. The transportation of waste would require appropriate permits and coordination with the Department of Transportation (DOT) and local traffic department. Traffic control plans would be required before remediation. The off-site disposal facilities would have to be in compliance with appropriate regulations.

Availability of Services and Materials

There are a number of stabilization facilities which can treat soils and sediments contaminated with organic/inorganic contaminants. Excavation and transportation utilize common construction equipments and should not pose any problems.

Cost

Total capital cost of this alternative is estimated to be approximately $270,000. No operation and maintenance is required for this alternative. Detailed supportive data used to derive at these estimates are presented in Appendix D.

Overall Protection of Human Health and the Environment: The excavation and removal of contaminated soil from the site would prevent leaching of contaminants into groundwater. This remedial measure involves off-site treatment which would totally reduce the toxicity, mobility and volume of hazardous contaminants. No secondary waste management would be required on site except for decontamination water from the decontamination of equipment and personnel. This alternative would restore the contaminated area to its natural state and would result in overall enhanced protection of human health and the environment.

Remedial Measure Containment/Groundwater Interception

In this alternative, contaminated groundwater in the overburden aquifer would be contained from moving off-site by dewatering activities associated with excavation of contaminated soils and from a well extraction line installed downgradient of the contaminated area. The well extraction line would consist of approximately five 4-inch diameter wells constructed out of PVC material installed to the top of bedrock. The wells would discharge to a containment vessel from which the contaminated groundwater would be pumped to the groundwater treatment system. Contaminated water would be pumped at a composite total pumping rate of approximately 2 gpm to 5 gpm (based on the estimated hydraulic conductivity of the overburden aquifer). Some of the wells made need to periodically cycled off to allow the aquifer to recharge the well. In addition, some of the existing monitoring will be assessed for conversion to extraction wells.

The contaminated groundwater would be treated on-site in a water treatment system consisting of pretreatment for removal of metals followed by carbon adsorption for removal of organics. The pretreatment train would consist of neutralization/pH adjustment, chemical precipitation, and filtration. The pretreated water would then be passed through a carbon adsorption system for removal of organic contaminants and then discharged on-site to the surface water. The treatment system would likely be located in an existing building, if structurally sound. Discharge to the POTW would be preferable, if available.

Effectiveness of this alternative will be enhanced by the removal of soils containing high concentrations of contaminants which are contributing to groundwater contamination.

Monitoring of the groundwater treatment system would be performed both to optimize the treatment process and to ensure that the effluent meets all requirements for surface discharge. Since on-site soils will be removed, it is possible that groundwater contamination levels will decrease significantly after a limited time, i.e., (less than 5 year pumping period). A security fence would be installed to restrict access and the site would be subject to 5-year reviews. For estimating purposes, a 30 year treatment period is assumed.

Assessment

Short-Term Effectiveness: Potential short-term risks during implementation of this remedial measure would be from direct contact with contaminated groundwater and inhalation of organic vapors from the groundwater treatment system resulting from leaks or accidental discharges. All pretreatment units would be enclosed and vented through a vapor phase carbon adsorption unit to minimize vapor emissions to air. Significant risk to operators could result from improper handling of reagent chemicals at the site. Proper operating procedures must be followed and precautions must be taken against normal construction hazards during the handling of all reagents and precautions. Exposure risk such as these would be mitigated through proper health and safety training and appropriate process controls such as automatic alarms and fail-safe shutdowns in case of leaks or overpressurization. The treatment plant construction area would be fenced and access restricted to authorized personnel; therefore, potential exposure to the general public would be minimal. Risks to the community from increased traffic during construction and transportation of treatment residuals are possible. No major environmental impacts would be expected from this alternative.

Total time for implementing this alternative including design, testing, bidding, selecting a contractor and installation of the treatment plant is estimated to be 12 months. Actual installation of the wells and treatment system is estimated to take approximately three months.

<u>Long-Term Effectiveness:</u> The major benefits associated with this alternative include long-term minimization of contaminant migration off-site and the removal of the primary contaminants of concern from the overburden aquifer. The groundwater would be treated prior to disposal to appropriate levels to maintain surface water quality as per NYSDEC requirements. The remediation would continue until concentrations of the primary contaminants of concern in the influent to the treatment plant are equal to or below the target cleanup levels (i.e., per NYSDEC) and/or to their corresponding upgradient concentrations or to the maximum extent possible.

<u>Reduction of Toxicity, Mobility or Volume:</u> This alternative would offer a significant reduction of toxicity, mobility and volume of the contaminants of concern by collecting and treating the contaminated groundwater from the overburden aquifer underlying the site. The treatment plant would be designed to reduce primary contaminant concentrations to target cleanup levels. Removal of soil is expected to eliminate a major source of groundwater contamination and therefore accelerate the groundwater cleanup.

<u>Implementability:</u>

Technical Feasibility

Low hydraulic conductivity values in existing monitoring wells as well as observed slow recharge effects may create technical difficulty in the groundwater extraction process. A 72-hour aquifer pumping test program should be performed to adequately assess the technical feasibility of overburden groundwater extraction. It should be noted that if a sustainable extraction rate cannot be achieved in the testing program, this remedial measure would not be viable.

The primary process steps of this alternative, including groundwater pumping, chemical precipitation, filtration, carbon adsorption and disposal have been used extensively to treat groundwater contaminated with metals and organic contaminants. All components of this alternative are well-developed and commercially available, and major technical problems which would lead to schedule delays are not expected. The treatment processes for this remedial alternative are conventional wastewater treatment processes and can be fabricated from off-the-shelf equipment or be purchased as prefabricated units. Proper operation and routine maintenance of the treatment plant would be required to achieve treatment goals. During the operation of the treatment system, effectiveness would be monitored by periodic analysis of contaminants in the treated groundwater before disposal.

Administrative Feasibility

This alternative would require extensive institutional management to ensure proper operation, maintenance and overall execution. Additionally, this alternative would require compliance with regulations regarding the transport and disposal of process residuals. Long-term institutional management would be required for the groundwater treatment system.

Long-term groundwater monitoring would be required to measure performance of the treatment system. Frequent reviews would be essential in assessing the effectiveness of this alternative in terms of contaminant concentration reductions by groundwater extraction and to implement appropriate alterations in the treatment process.

Availability of Services and Materials

The treatment systems for this alternative are conventional treatment processes and can be fabricated from commercially available equipment. Several suppliers are available for every type of equipment or technology required for this alternative. Competitive bids can thus be obtained. Similarly, specialists are available for the design, construction and operation of this alternative as required. Spent carbon from the adsorption system could be disposed of at an approved off-site disposal facility or regenerated commercially. Pretreatment sludge would be disposed of off site at a landfill. Depending on results of TCLP testing, a RCRA landfill would be required.

Cost

The capital cost for this alternative is estimated to be approximately $300,000. The annual operation and maintenance cost is estimated to be $100,000. However, this number is subject to significant variability. For example, should POTW discharge be available and can be successfully negotiated, the O&M cost will drop significantly. Conversely, based on the contaminant loading frequency of treatment material replenishment, and actual system flow rate, the annual O&M cost could be higher. Refinement of the O&M value cannot be made without additional information typically developed during the Remedial Design stage. Data in support of the capital cost estimate is presented in Appendix D.

Overall Protection of Human Health and the Environment: The treatment system provided would remove the contaminants of concern in the extracted groundwater to state groundwater standard levels and the treated groundwater would be discharged to surface water on site. Treating the contaminated groundwater to state water standards would allow for future use of the aquifer. This alternative would result in protection of the environment.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Chlorinated aliphatic VOCs (e.g., trichloroethene, cis-1,2-dichloroethene, vinyl chloride) were detected at concentrations less than 5 ug/L in the septic tank/leach pit water and were not present in the sludge from the tank/pit samples during the RI/FS sampling investigation. This indicates a decrease from the previous investigation events, as this class of VOCs had been present up to 15,000 ug/L in the tank/pit waters and 2,600 ug/kg in the sludge. A decrease of up to 7.2 times and 108 times in concentration of the chlorinated aliphatic VOCs in surface water and sediments, respectively, was also noted. Presently, occurrences were noted up to 18 ug/L (surface water) and 25 ug/kg (sediment). The groundwater beneath the former Magna Metals property contained concentrations of trichloroethene (maximum of 4,700 ug/L) and tetrachloroethene (maximum of 90 ug/L) during the RI/FS investigation; no previous groundwater samples were collected.

The investigation indicated concentrations of PAH constituents. In general, PAH compounds occur from the burning of oils, wood, coal, gas, etc.; from wood processing and treating operations; and from the manufacture of plastics, chemicals and dyes. PAHs are generally not typical of the bi-products found in the waste stream from metals plating operations. The septic tank/leach pit sludge contained 8 PAHs, up to 1,500 ug/kg. In addition, concentrations greater than applicable criteria occurred in 7 of the 11 sediment samples (64 percent) and 1 of the 5 surface soil samples (20 percent). A majority of the maximum sediment concentrations (16 of 18, or 89 percent) for this class of compounds occurred at location SD-1 (the drainage culvert). Runoff from nearby Cross Road Avenue may be a contributing factor to the culvert concentrations. Concentrations of PAHs less than 4 ug/L and 160 ug/kg, respectively, were detected in the surface water and subsurface soils. Previous investigations at the site did not analyze samples for PAHs. The exact source of the pesticides and PCBs is currently unknown, and these constituents were possibly introduced into the areas by actions after ISC Properties sold the site in 1982.

Pesticides and PCBs were not detected in the septic tank/leach pit water or surface water historically sampled in May 1984. Neither of these matrices contained pesticides or PCBs during the RI/FS investigation. Pesticides and PCBs occurred, though, in the other matrices sampled (i.e., the septic tank/leach pit sludge, sediments, surface and subsurface soils, and groundwater). The existence of pesticides on the site has no historical documentation. PCBs were used in capacitors and transformers, and in the manufacture of hydraulic fluids, lubricants, inks, adhesives, and pesticide extenders. The exact source of the PAHs is currently unknown, and these constituents were possibly introduced into the areas by actions after ISC Properties sold the site in 1982.

Investigations conducted in 1982 (and prior to) at the site indicated that inorganic constituents were generally confined to the septic tanks and leach pits. In 1982, after an extensive investigation, NYSDEC concluded that the site did not pose a threat to the environment. Water and sludge samples from the tanks/pits collected during 1984 had noted elevated concentrations of arsenic, copper, nickel, seleniuim, and/or zinc. Occurrences at reduced concentrations were detected in the nearby surface water and sediments during the previous investigations. During the RI/FS sampling, metals and cyanide were detected in the water and sludge samples from the tanks/pits. Detection of inorganic constituents in the post-1982 investigations suggests that metals may have been further introduced after 1982. During the current investigation, exceedance concentrations for the inorganics were detected in the tributary (SW-6/SD-6) and/or wetlands (SW-7/SD-6 and SW-9/SD-9) samples. In addition, the surface soils, subsurface soils and groundwater samples collected downgradient from the tanks/pits contained inorganic exceedance concentrations.

The chemical data collected during the RI indicated that all media sampled, i.e., groundwater, surface water, surface soil, sediment, and subsurface soil were affected by organic and inorganic contaminants of concern. With regards to groundwater, specifically off-site overburden groundwater, on-site bedrock groundwater, and off-site bedrock groundwater, contaminant concentration, if any, are unknown at this time. Based on exceedances of NYSDEC Water Quality Standards (Class GA) in two of the three downgradient overburden monitoring wells MW-03 and MW-04, additional downgradient investigation of the overburden is warranted. Since it is also possible that the contaminated overburden aquifer and underlying bedrock aquifer are hydraulically interconnected through a bedrock fracture system, the potential exists for contaminants to migrate downwards. Therefore, an on-site bedrock well should be installed, and if contamination is found, additional bedrock groundwater delineation should be performed.

Should off-site overburden and/or bedrock contamination become apparent, it should be noted that there are significant limitations in achieving remedial action success as fractured bedrock systems tend to act as heterogeneous groundwater units making contaminant removal difficult to achieve. Similarly, based on the presence of wetlands off-site, overburden is anticipated to have a high silt/clay content which has a tendency to "hold" contaminants. As a result, prior to performance of any future feasibility study analysis, an assessment should be made regarding actual risk posed to current and future human and environment populations potentially exposed to groundwater contamination and the pathways which would potentially be exposed. To evaluate human health risks, several exposure pathways should be considered which would include the following:

- Ingestion of groundwater,
- Dermal contact with groundwater, and
- Inhalation of volatiles from groundwater.

Any future field investigation activity should also consider correlating the relationship of groundwater flow and its potential discharge to the wetlands area downgradient of the site. Should a connection exist and Contaminant of Concerns (COCs) warrant further evaluation, the risk assessment should consider the following exposure pathways.

- Ingestion/direct contact with surface water,
- Inahalation of volatiles from surface water, and
- Ingestion of fish from the pond and stream.

With respect to the results of the Habitat Based Assessment which incorporated surface soil, sediment, and surface water data, the following was noted:

Down-gradient concentrations of the metals aluminum, copper, iron, mercury, zinc, and cyanide exceeded the NYSDEC Water Quality Standards, and selenium exceeded EPA chronic and acute criteria in the surface water samples. Down-gradient levels of copper, nickel, chromium, and zinc surpassed the NYSDEC severe effect level for sediments. In the down-gradient surface soil samples, aluminum, chromium, copper, selenium, vanadium, and zinc were detected at concentrations that were greater than the screening benchmark concentrations. Concentrations of aluminum, chromium, selenium, and vanadium were also higher than the screening benchmark concentrations in the background surface soil samples. In addition, levels of PCBs aroclor- 1254 and aroclor-1260, and the semi-volatile organic compound di-n-butylphthalate exceeded the screening benchmark concentrations in the down-gradient surface soil samples.

Based upon these results, the following conclusions were drawn. It should be noted that removal of soils in the source area would likely eliminate the potential for exposure in the first two findings.

- Within the boundaries of the site perimeter, no significant areas for supporting ecological receptors was documented. However, surface drainage from the site is directed into adjoining wetlands and streams deemed as sensitive environments (including a NYSDEC regulated wetland) supporting ecological receptors. Given that the principal fate and transport mechanism for site related contaminants is the surface water pathway, the potential for exposure of ecological receptors to site related contaminants remains viable.

- Elevated concentrations of aluminum, chromium, copper, selenium, vanadium, and zinc were associated with on-site surface soils. While present at elevated concentrations, the developed nature of the site limits the surface soil exposure pathway for most ecological receptors. However, contaminated soils may function as a potential source for exposing ecological receptors downstream via erosion and runoff into adjoining streams and wetlands.

- Site related contaminants including aluminum, copper, iron, mercury, zinc, and cyanide are present in surface water at elevated concentrations above background and corresponding acute and chronic AWQC in the adjoining streams and wetlands.

- Site related contaminants including copper, nickel, chromium, and zinc are present in the sediments at concentrations above background and corresponding low and severe sediment quality criteria in the adjoining streams and wetlands.

The presence of site related contaminants exceeding applicable ecological benchmarks in the surface water and sediments of adjoining sensitive environments appears to present a pathway for exposure of ecological receptors to site related contaminants. It also suggests that impacts may be occurring in the streams and or wetland area. It is recommended that the FWIA continue through a Step IIC Toxic Effects Analysis, which should focus on the aquatic communities, surface water and sediments of the tributaries and adjoining wetlands to determine if the potential exposure to site related contaminants are impacting aquatic communities and if remedial actions are warranted.

On-site subsurface soil and overburden groundwater were adequately delineated and therefore, an evaluation of potential remedial measures to address these affected media was performed. The objectives developed in the screening analysis consisted of restoring contaminated subsurface soil in the leach pit/holding tank area (which also provides a continued additive source to overburden groundwater levels via either groundwater flow or precipitation infiltration) to background conditions and containment of overburden groundwater in order to prevent further migration off-site. However, prior to implementation of the containment option, a 72-Hour Aquifer Pumping Test Program should be performed to verify the feasibility of groundwater extraction due to low hydraulic conductivity values derived from the RI slug tests and also due to slow monitoring well recharge effects seen in the field.

8.0 REFERENCES

Clayton, 1981. Clayton, George and Florence Clayton (editors), Patty's Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York. 1981.

NYSDEC, 1986. Water Quality Regulations, Title 6, Chapter X, Parts 701 and 703, New York State Division of Environmental Conservation, March 1986.

NYSDEC, 1993a. Ambient Water Quality Standards and Guidance Values, New York State Division of Environmental Conservation, October 1993.

NYSDEC, 1993b. Technical Guidance for Screening Contaminated Sediments, New York State Division of Environmental Conservation, November 1993.

NYSDEC, 1994. Division Technical and Administrative Guidance Memorandum (TAGM): Determination of Soil Clean-up Objectives and Clean-up Levels, New York State Division of Environmental Conservation, January 1994, revised from November 1992.

APPENDIX A

GEOPHYSICAL DATA

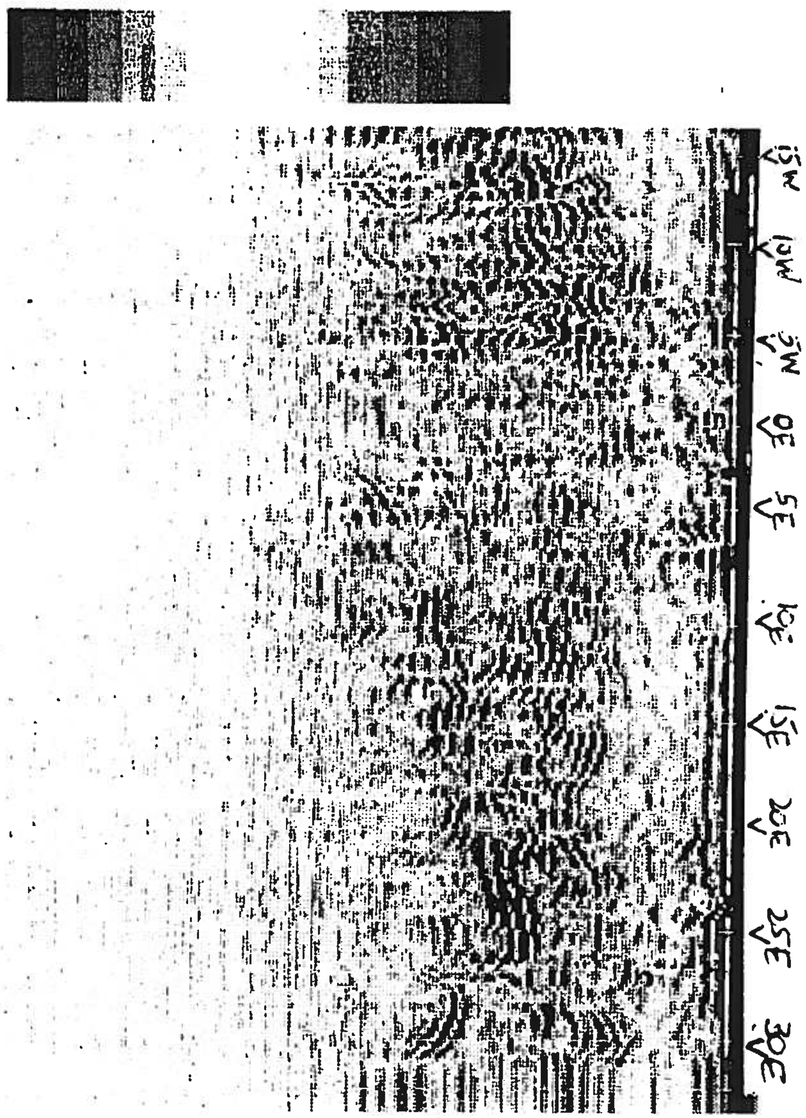
GPR DATA FINDINGS

A strong hyperbolic reflection was consistently observed in data along scans depicted in Files 28, 29, 31, 32, and 43 which may be attributed to subsurface pipe, or pipes, estimated to trend in a north-south direction, a distance of between 15 to 20 feet west of the former Magna Metals building (Figure 1). A characteristic signature of a subsurface tank was determined by collecting a number of scans (i.e., Files 10, 11, and 12) over a known location of a subsurface tank and comparing this signature to subsequent data collected. The raw GPR data collected over the site and within this appendix correspond to scan lines depicted in Appendix A, Figure 1. Also included in this map is a geophysical interpretation of the site in which suspected locations of subsurface tanks and potential appurtenant piping are displayed. An area of potential conductive material is displayed that was evidenced by an increase rate of EM attenuation. A shallow reflective zone is also displayed in the figure as evidenced along Files 13 and 14 at a depth of about three feet below ground surface. These findings were later used to guide the leach pit sampling program.

:LE32(11/21/96 13:39:32) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
ielectric: 1.00

osition: 0.0nS Range: 100.0nS
inge Gain 18 40 52 52 55
:IIR LP N=1 F=1078)
:IIR HP N=2 F=67)
:IIR STK TC=4)

able #15; Transform #1

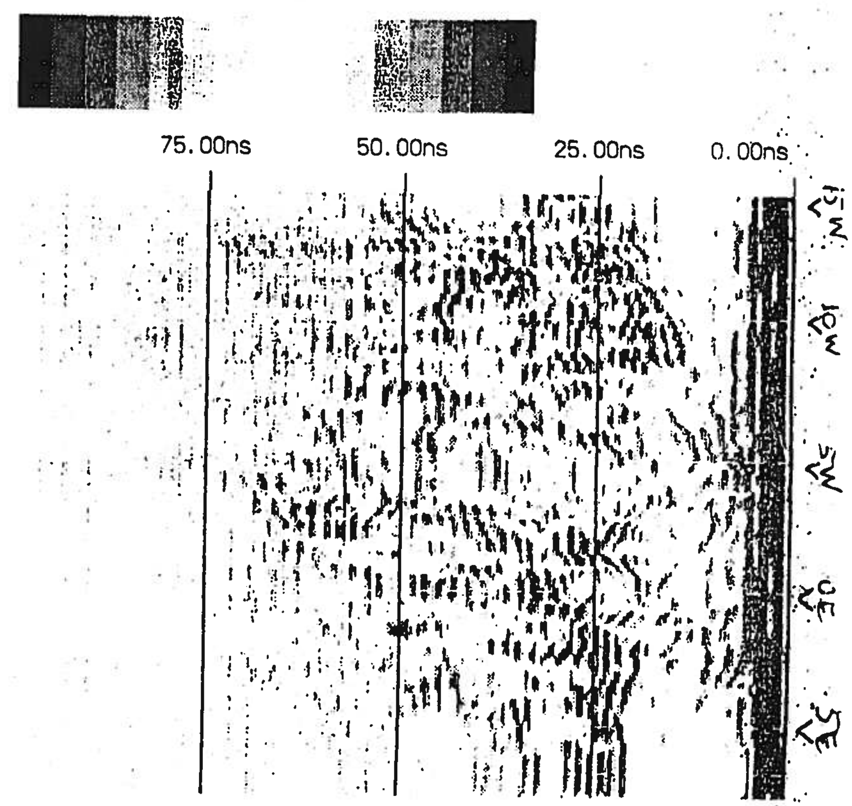


FILE 32

FILE34(11/21/96 13:45:52) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

Table #15; Transform #1

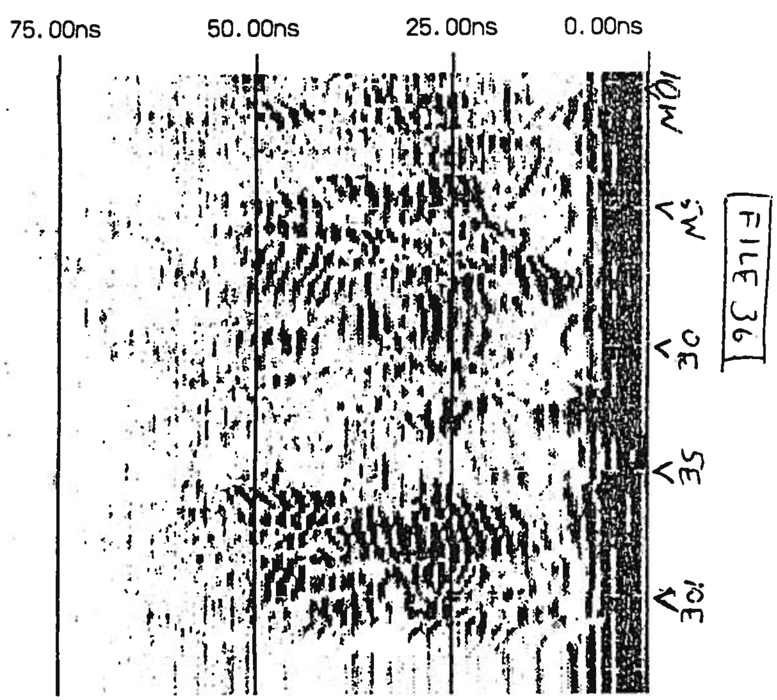


FILE 34

FILE36(11/21/96 13:50:52) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

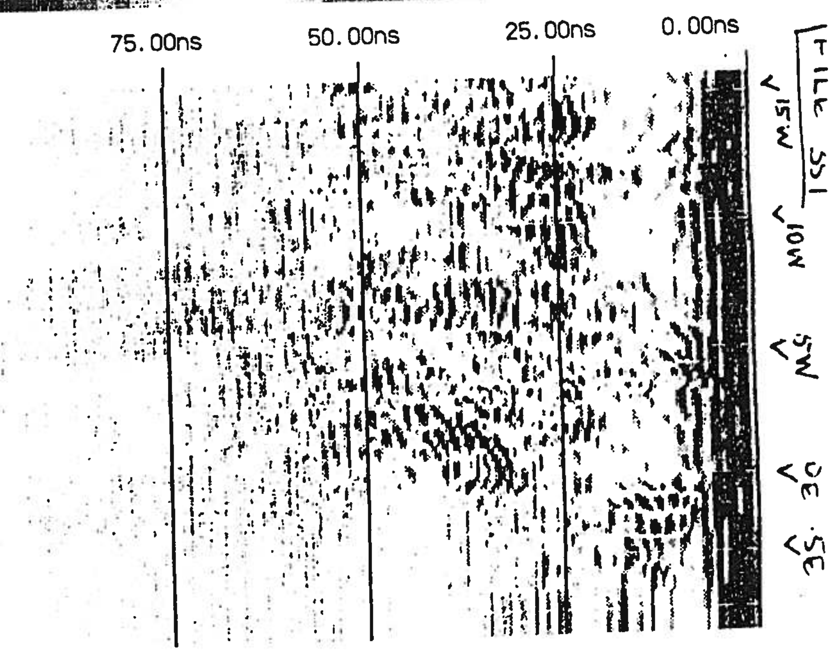
Table #15; Transform #1



FILE35(11/21/96 13:47:50) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

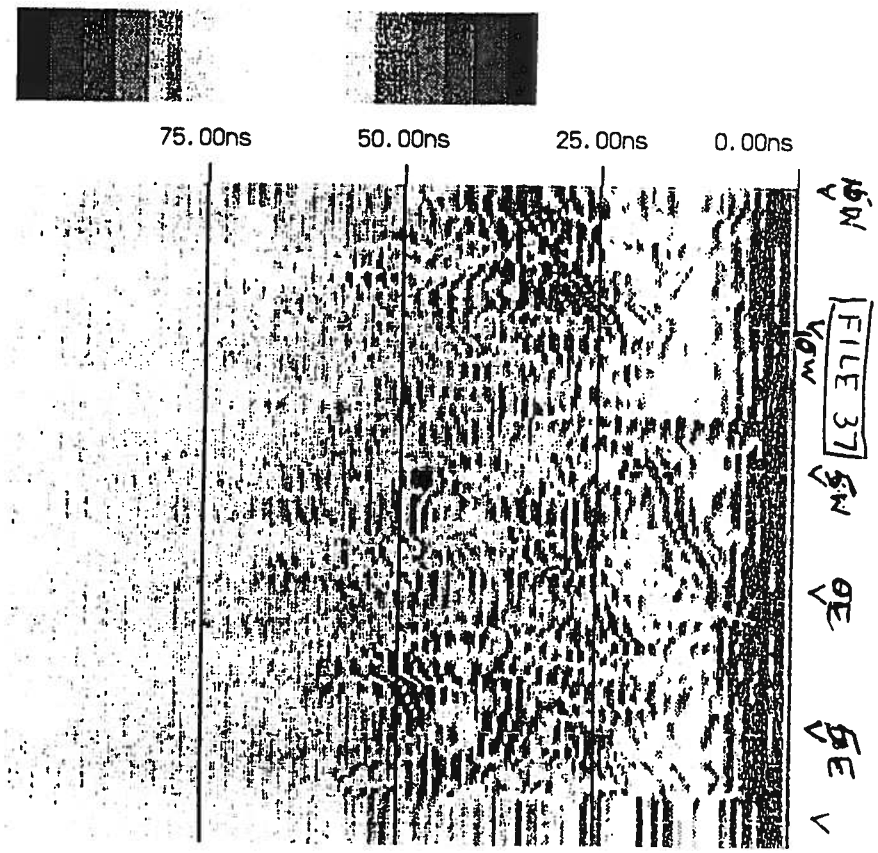
Table #15; Transform #1



FILE37(11/21/96 13:52:58) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

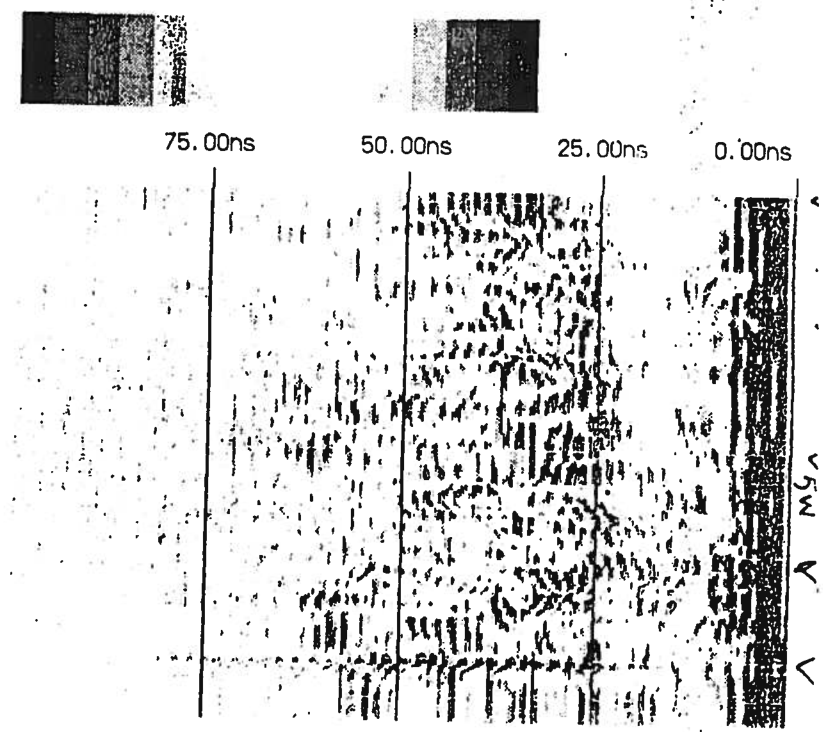
Table #15; Transform #1



FILE38(11/21/96 13:55:08) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

Table #15; Transform #1

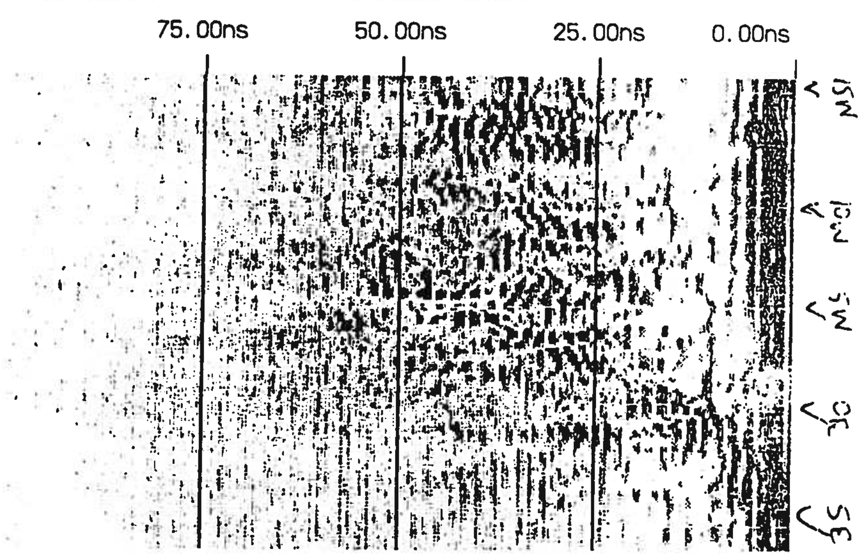


FILE 39

FILE39(11/21/96 13:56:22) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

Table #15; Transform #1

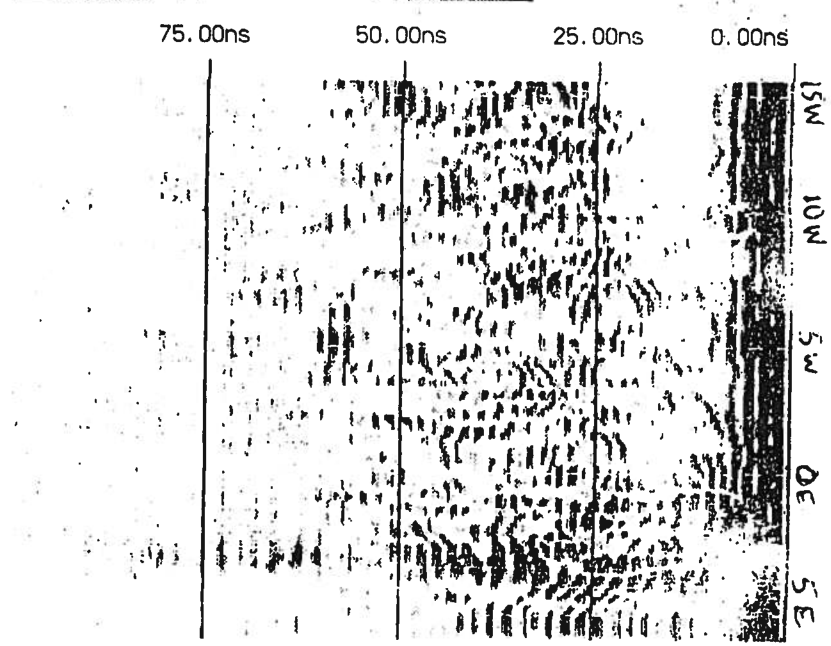


FILE 40

FILE40(11/21/96 13:57:52) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

Table #15; Transform #1



FILE43

FILE43(11/21/96 14: 024

Scan/Sec 16.0 Bits: 8

ectric: 1.00

tion: 0.0nS Range: 100.0nS

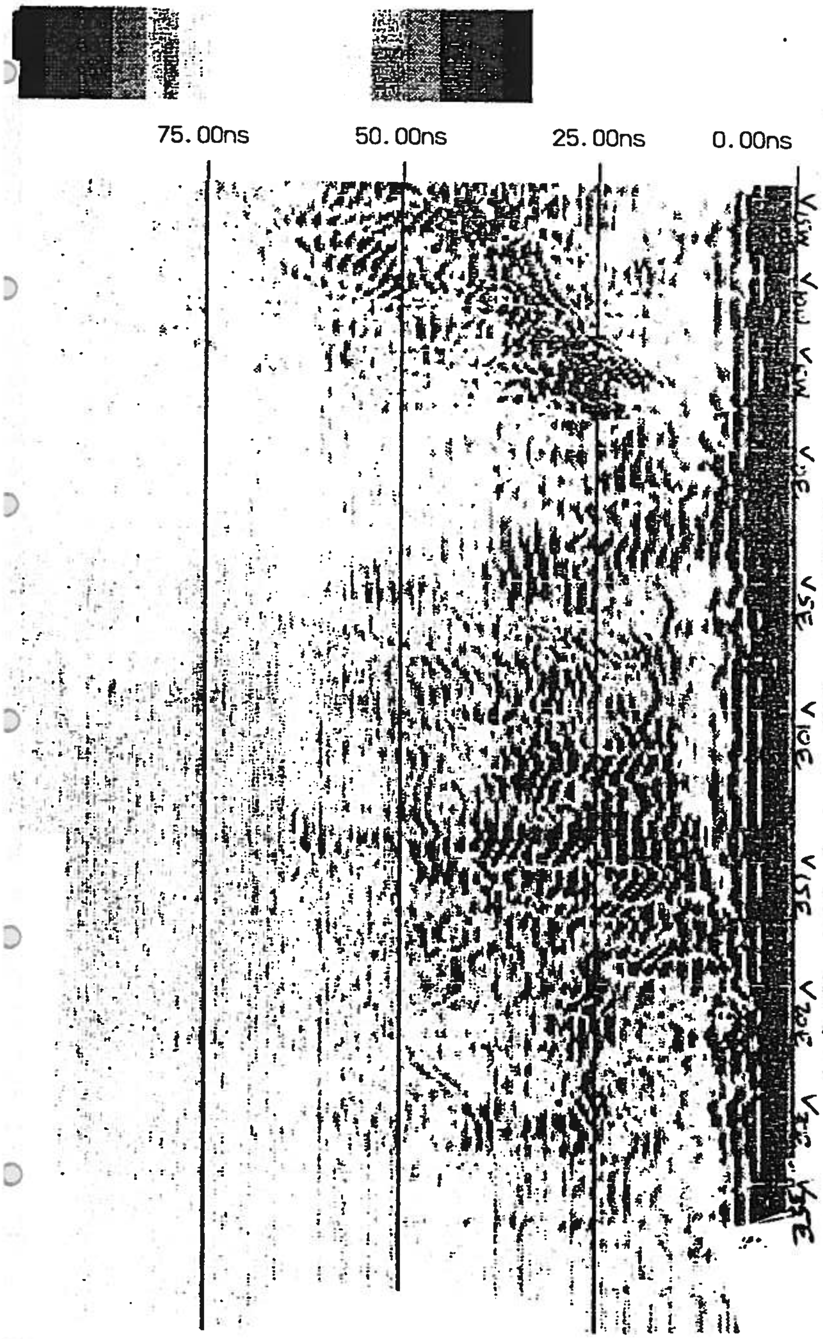
e Gain 18 40 52 52 55

IR LP N=1 F=1078)

IR HP N=2 F=67)

IR STK TC=4)

le #15; Transform #1



FILE 41

/96 14:00:12)

Scan/Sec 16.0 Bits: 8

electric: 1.00

sition: 0.0nS Range: 100.0nS

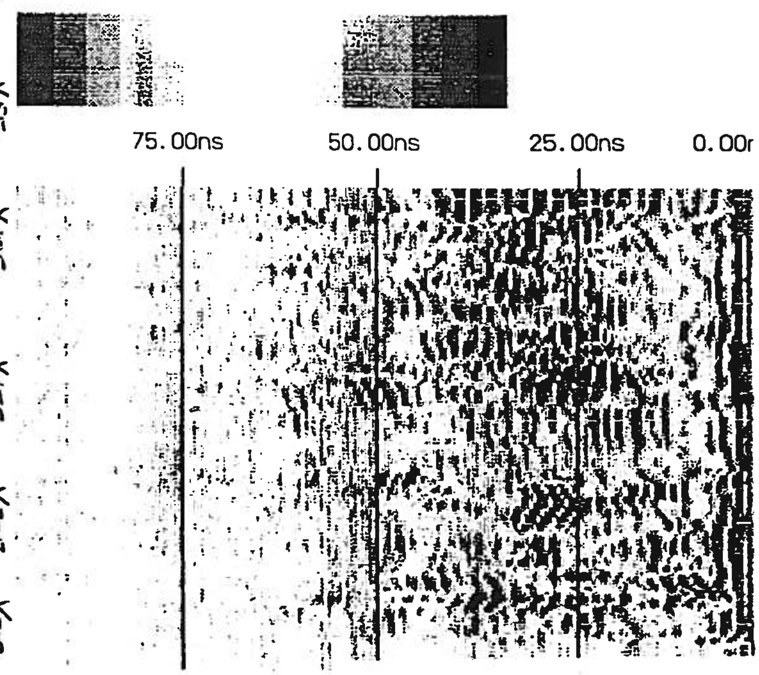
ge Gain 18 40 52 52 55

IR LP N=1 F=1078)

IR HP N=2 F=67)

IR STK TC=4)

le #15; Transform #1

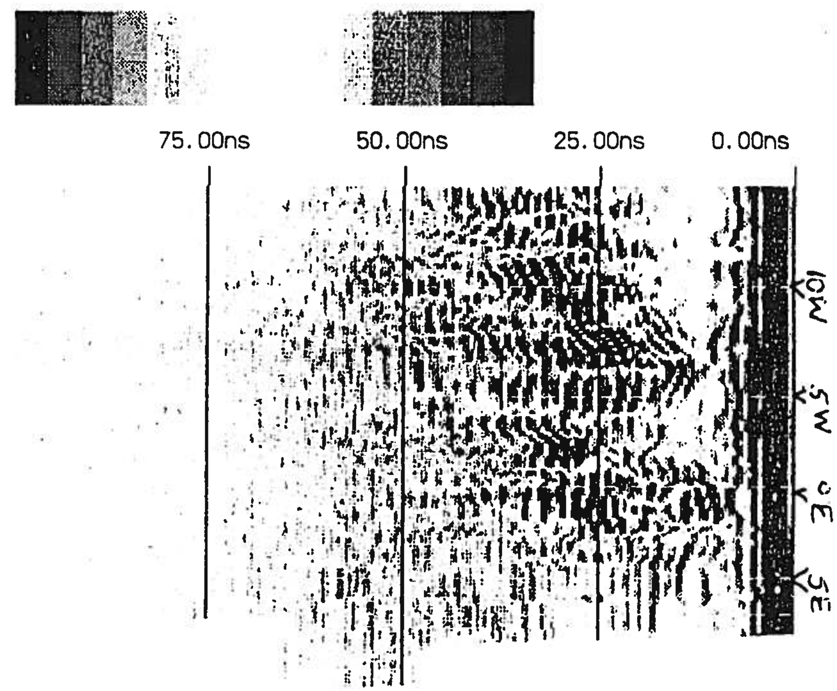


-,/96 14:01:24) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
V(IIR HP N=2 F=67)
H(IIR STK TC=4)

Table #15; Transform #1

FILE 42



ILE44(11/21/96 14:07:22) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
ielectric: 1.00

osition: 0.0nS Range: 100.0nS
ange Gain 18 40 52 52 55
(IIR LP N=1 F=1078)
(IIR HP N=2 F=67)
(IIR STK TC=4)

able #15; Transform #1

FILE 44

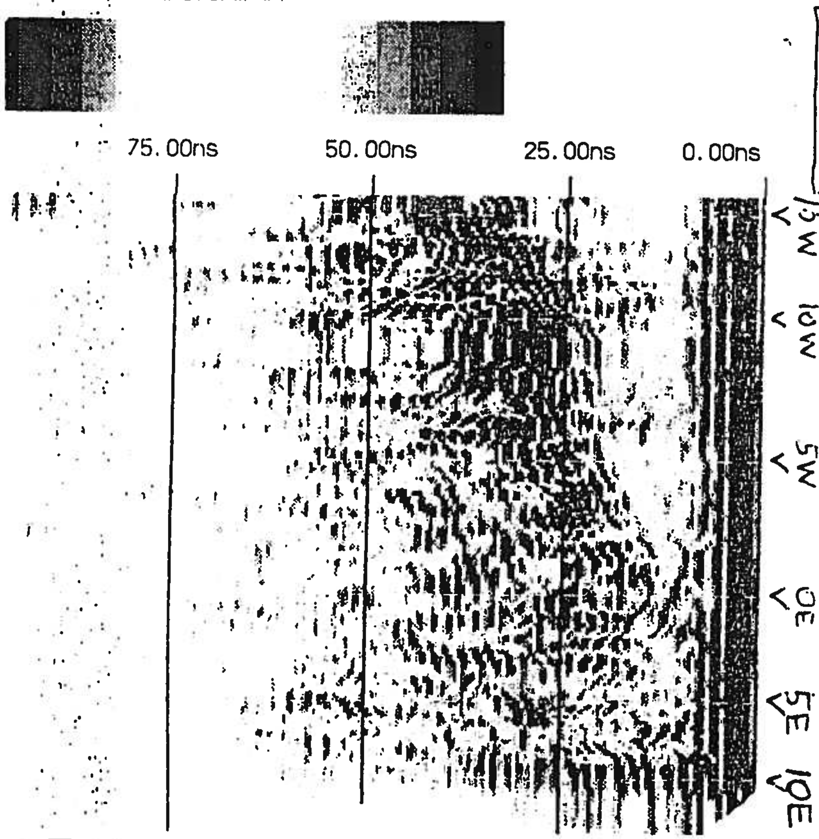
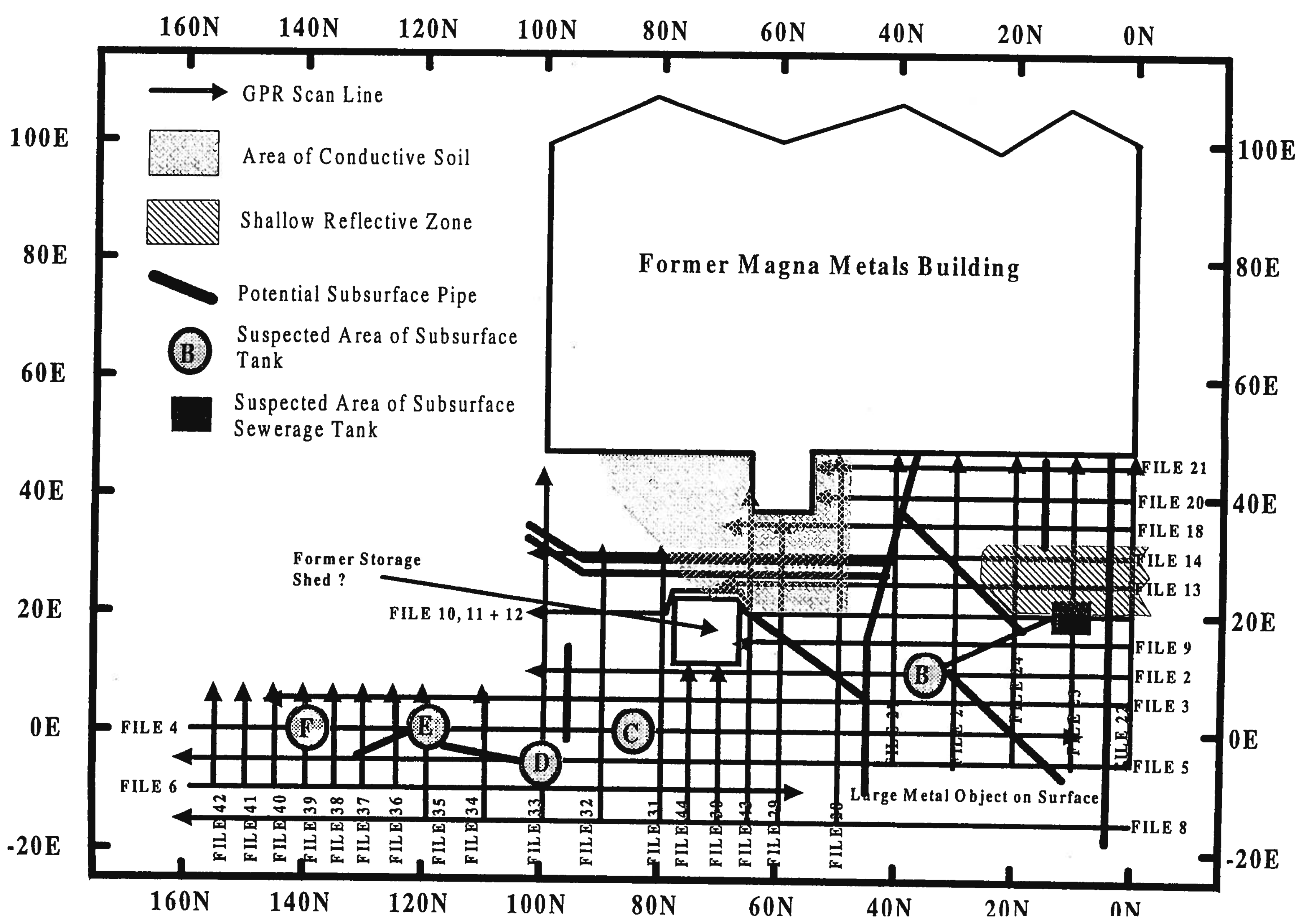


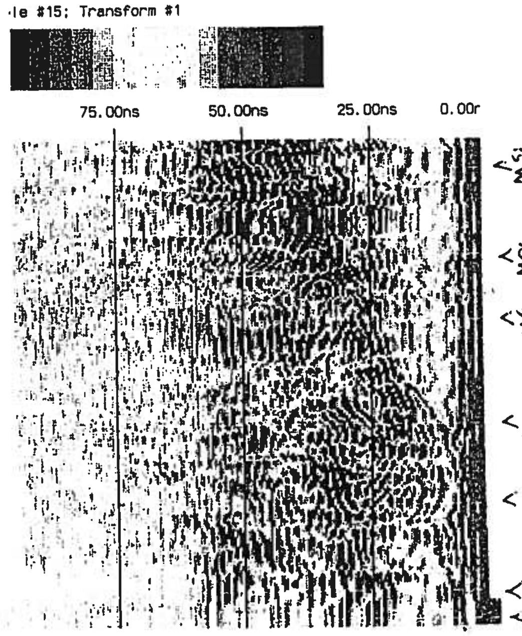
Figure 1: Map of Magna Metals Site Displaying GPR Scan Lines Conducted and and Subsurface Targets of Interest Detected.



E30(11/21/96 13:34:22) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
lectric: 1.00

ition: 0.0nS Range: 100.0nS
ge Gain 18 40 52 52 55
IR LP N=1 F=1078)
IR HP N=2 F=67)
IR STK TC=4)

le #15; Transform #1

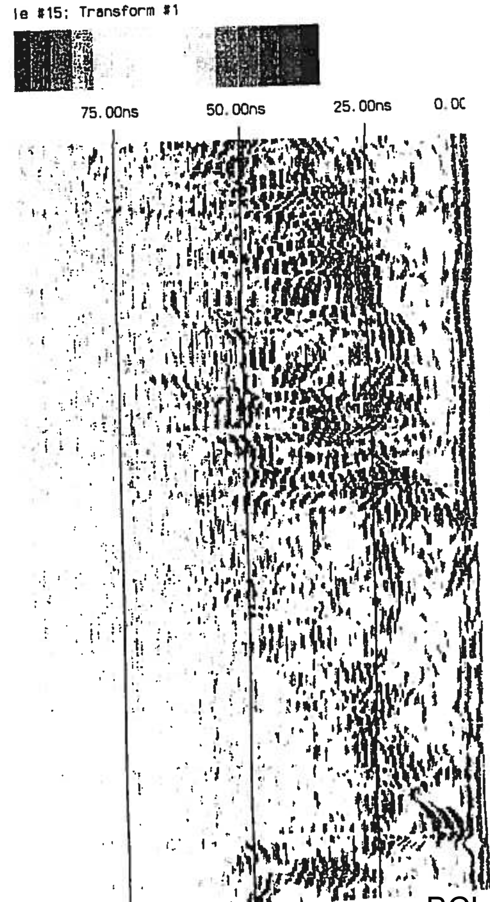


FILE 30

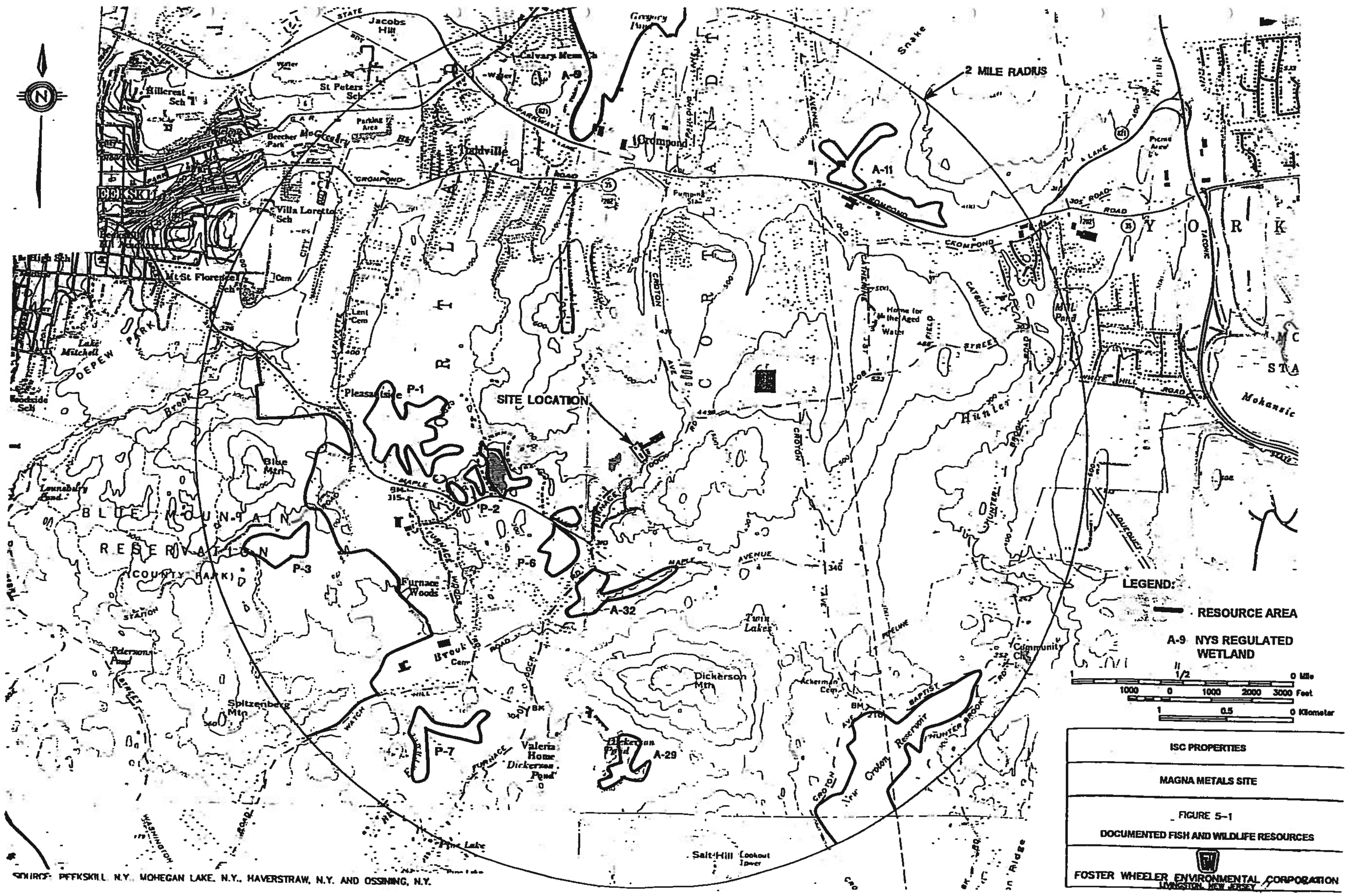
E31(11/21/96 13:36:12) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
lectric: 1.00

ition: 0.0nS Range: 100.0nS
ge Gain 18 40 52 52 55
IR LP N=1 F=1078)
IR HP N=2 F=67)
IR STK TC=4)

le #15; Transform #1



FILE 31



ISC PROPERTIES

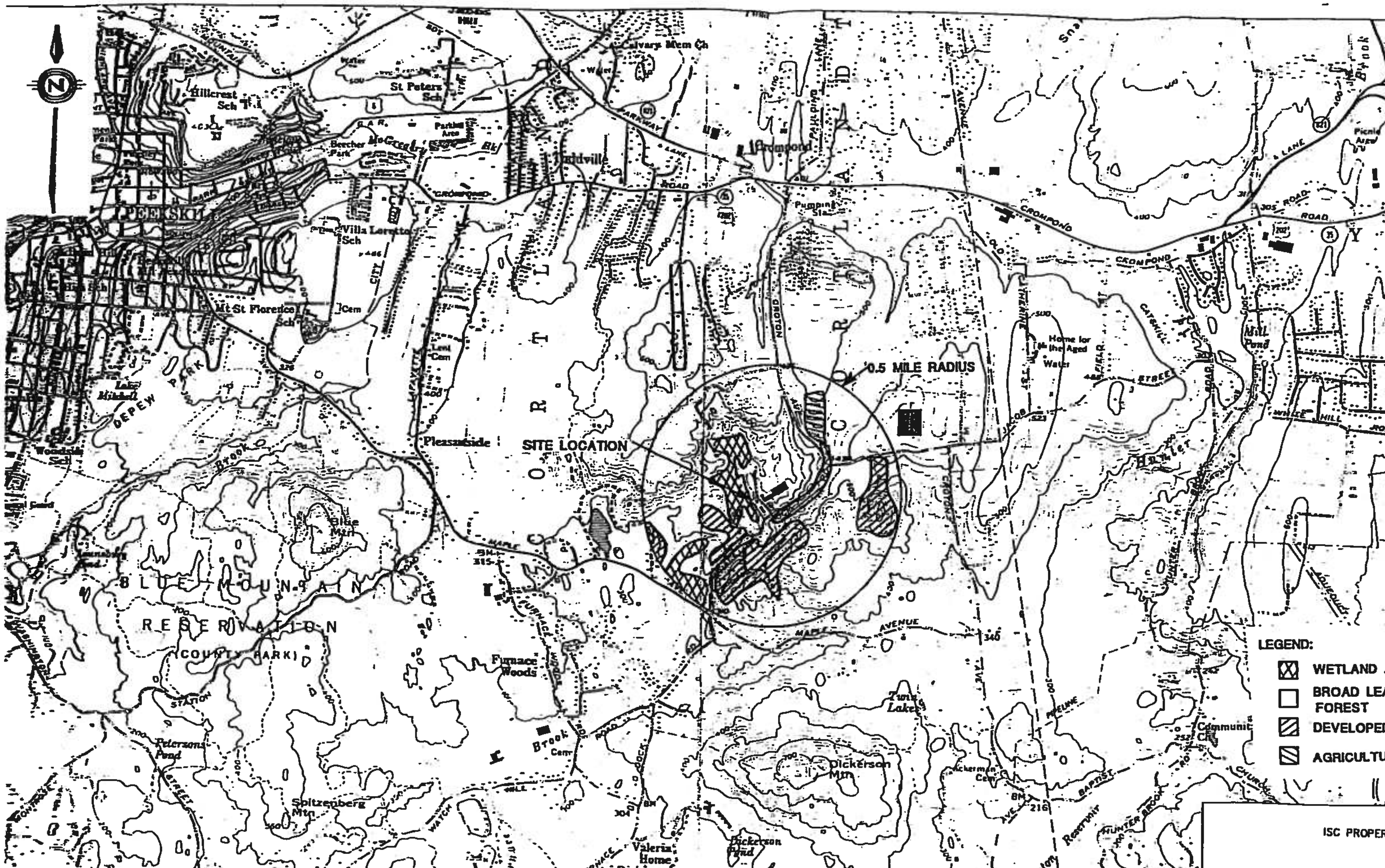
MAGNA METALS SITE

FIGURE 5-1

DOCUMENTED FISH AND WILDLIFE RESOURCES

FOSTER WHEELER ENVIRONMENTAL CORPORATION
LIVINGSTON, NEW JERSEY

BCLP02623



LEGEND:

- WETLAND AREA
- BROAD LEAF DECIDUOUS FOREST
- DEVELOPED LAND
- AGRICULTURE LAND

ISC PROPERTIES

FIGURE 5-2
COVER TYPE MAP
MAGNA METALS SITE
CORTLAND, WESTCHESTER COUNTY, N.Y.

FOSTER WHEELER ENVIRONMENTAL CORPORATION
LIVINGSTON, NEW JERSEY

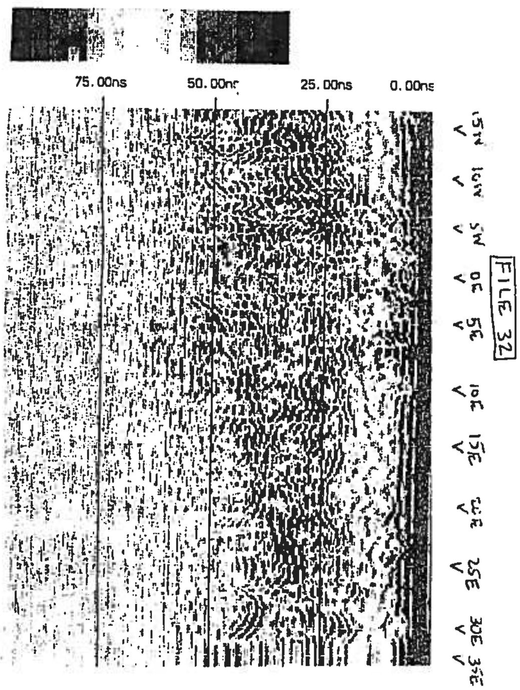
SOURCE: PEEKSKILL, N.Y., MOHEGAN LAKE, N.Y., HAVERSTRAW, N.Y. AND OSSINING, N.Y.
7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLES

BCLP02624

. FILE32(11/21/96 13:39:32) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
lectric: 1.00

ition: 0.0nS Range: 100.0nS
ge Gain 18 40 52 52 55
IR LP N=1 F=1078)
IR HP N=2 F=67)
IR STK TC=4)

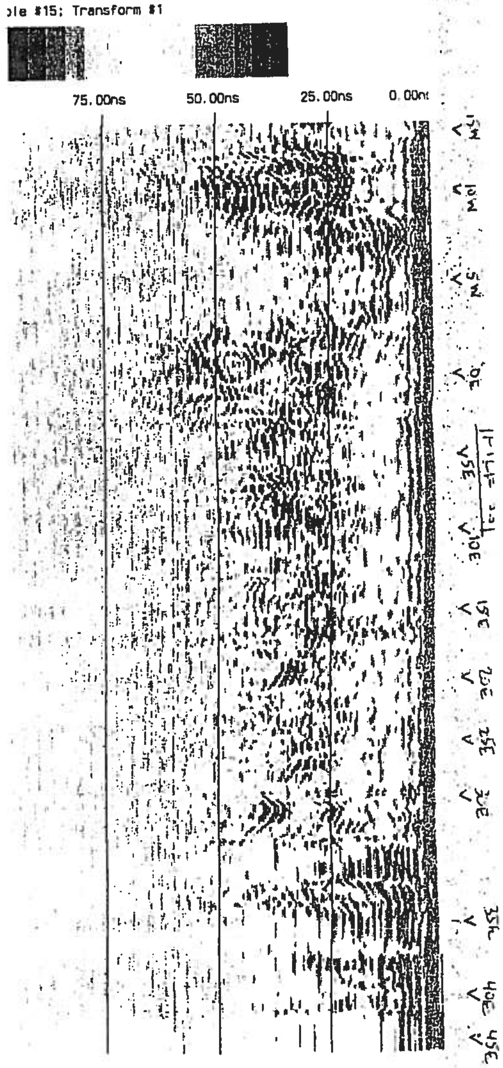
>le #15; Transform #1



'LE33(11/21/96 13:42:12) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
:IIR HP N=2 F=67)
IIR STK TC=4)

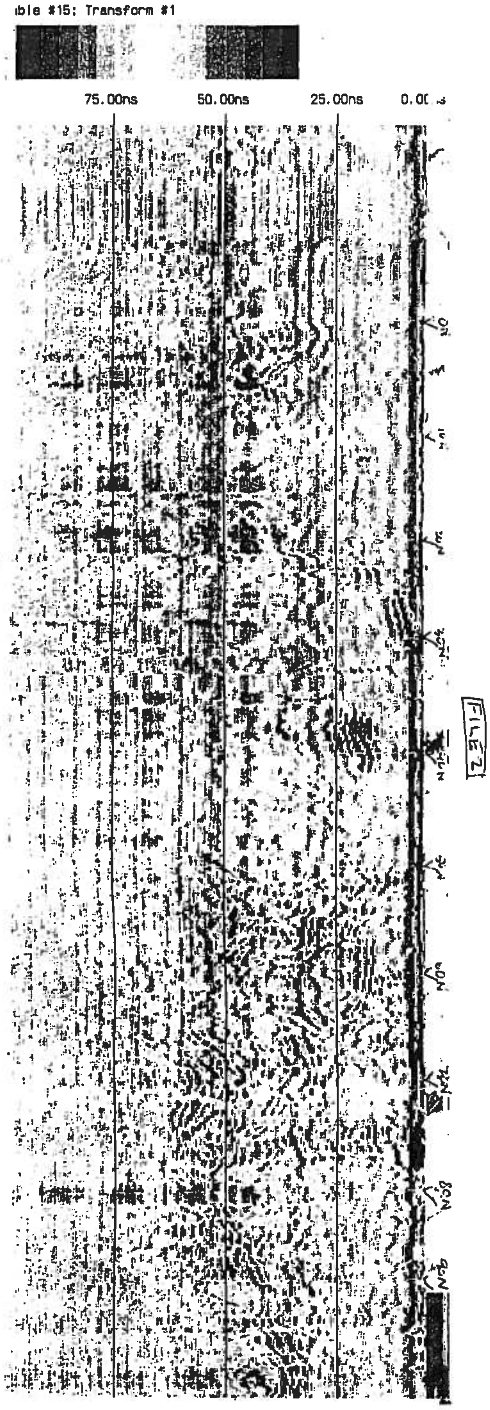
>le #15; Transform #1



FILE2(11/21/96 11:40:04)
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
nge Gain 16 33 49 52 54
IIR LP N=1 F=1000)
IIR HP N=2 F=10)
IIR STK TC=4)

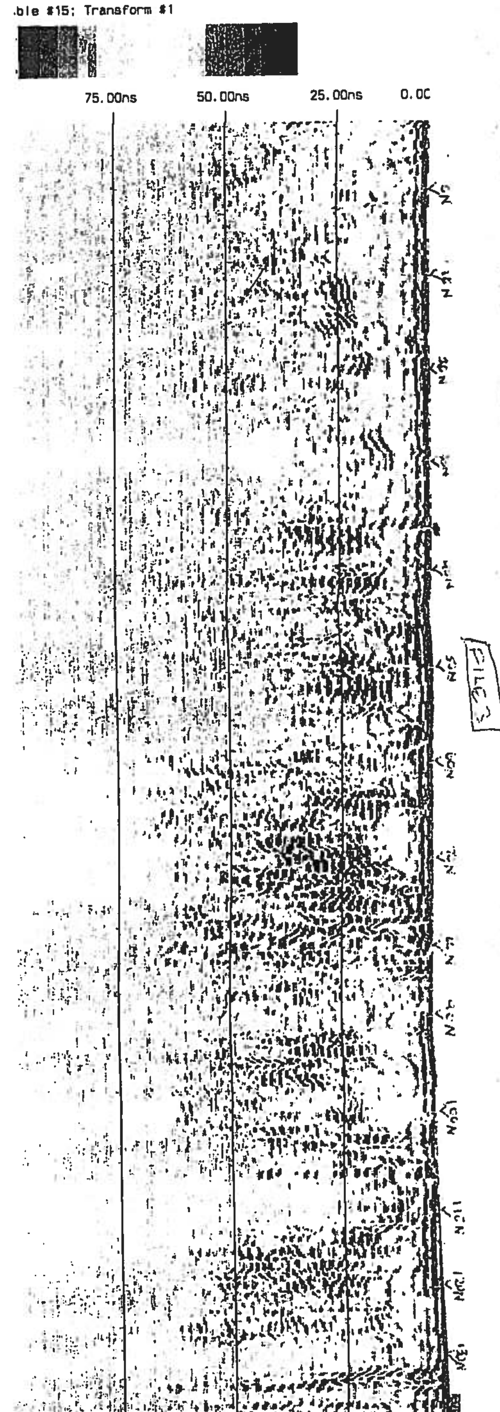
ble #15; Transform #1



FILE3(11/21/96 12:23:48) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 16 40 52 52 55
IIR LP N=1 F=1076)
IIR HP N=2 F=67)
IIR STK TC=4)

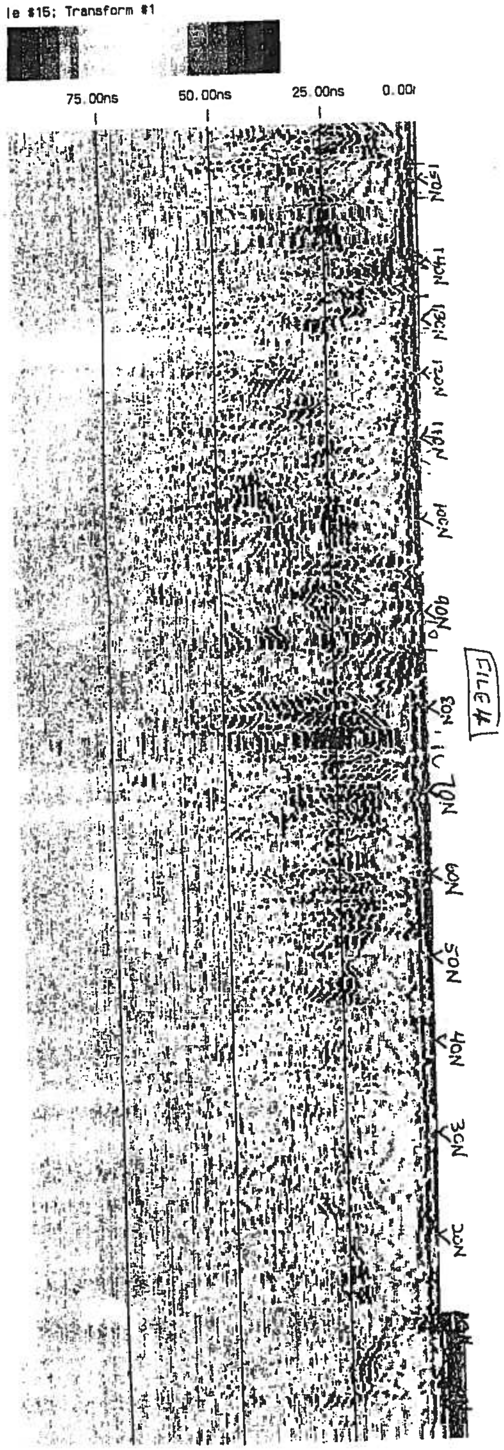
ble #15; Transform #1



FILE 4 (11/21/96) Samples/scan: 1024
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

ition: 0.0nS Range: 100.0nS
ge Gain 18 40 52 52 55
IR LP N=1 F=1078)
IR HP N=2 F=67)
IR STK TC=4)

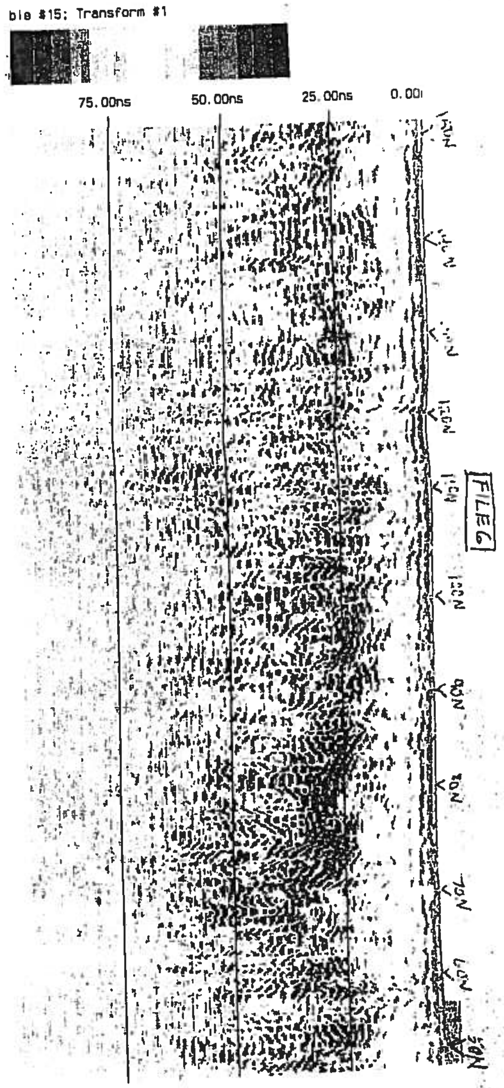
le #15; Transform #1



FILE6(11/21/96
Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

Position: 0.0nS Range: 100.0nS
Range Gain 18 40 52 52 55
V(IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

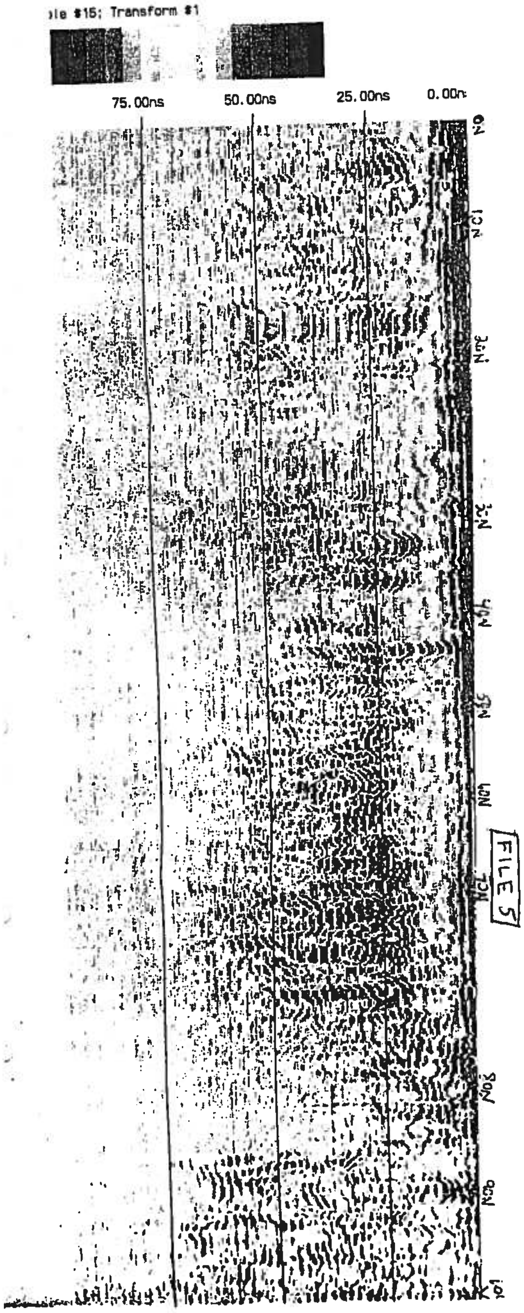
ble #15; Transform #1



FILE5(11/21/98 12:31:38) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
(IR HP N=2 F=67)
IIR STK TC=4)

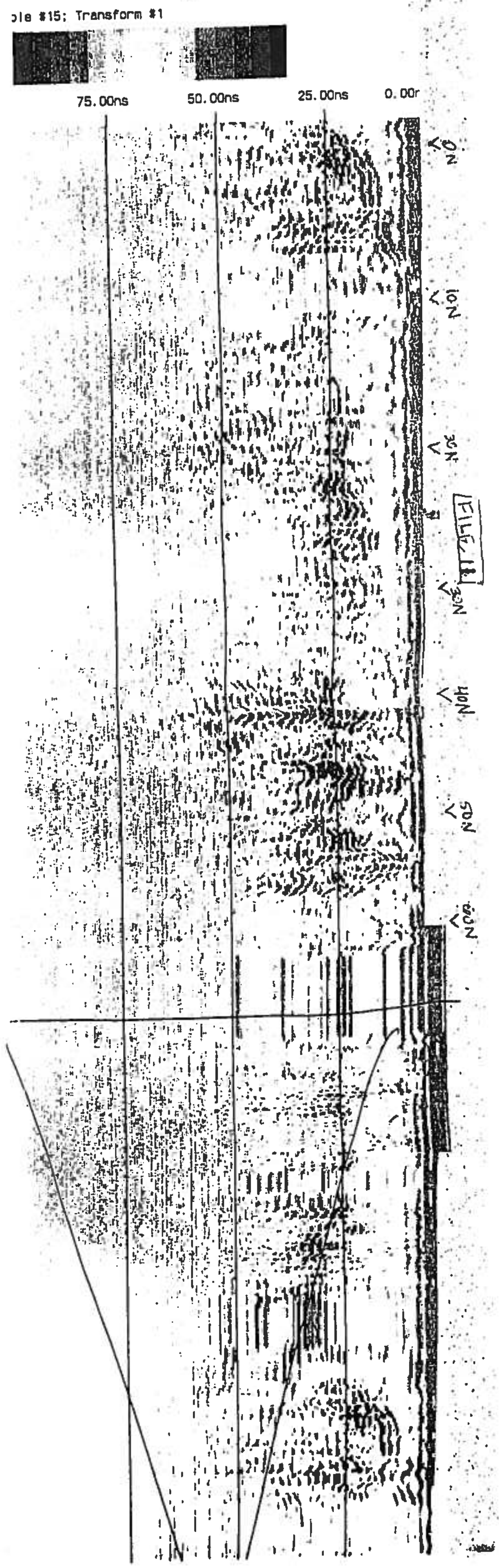
ble #15; Transform #1



Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

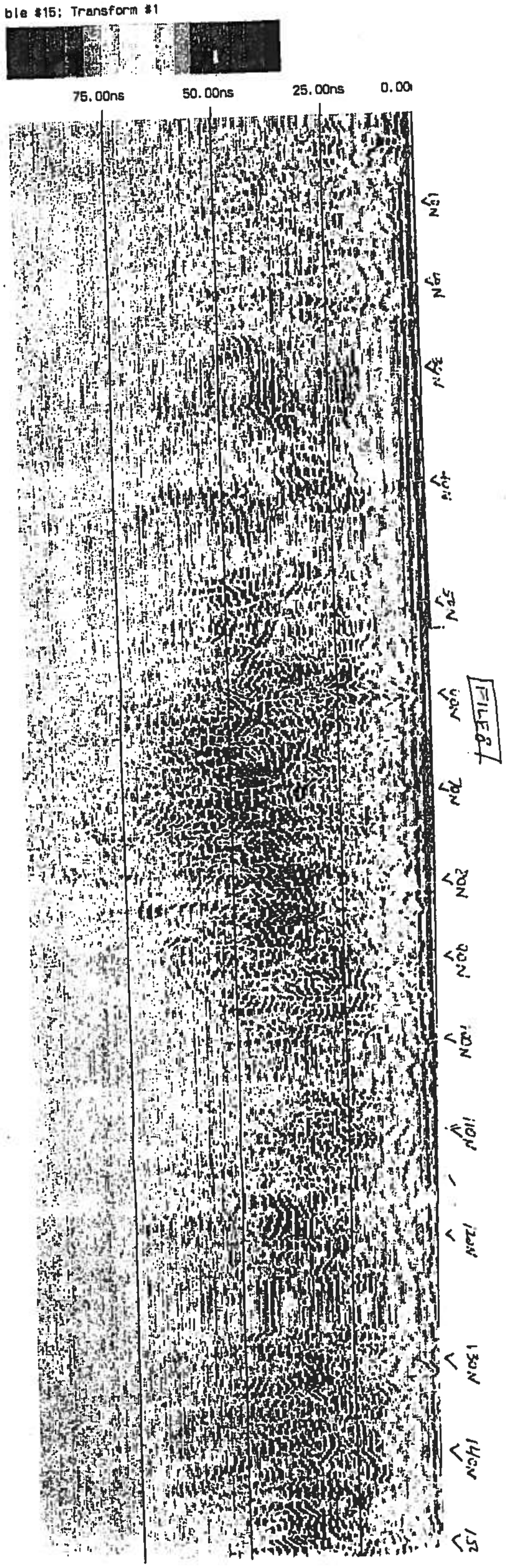
ble #15; Transform #1



FILE 8 (11/21/96) Scan/Sec 16.0 Bits: 8
Dielectric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

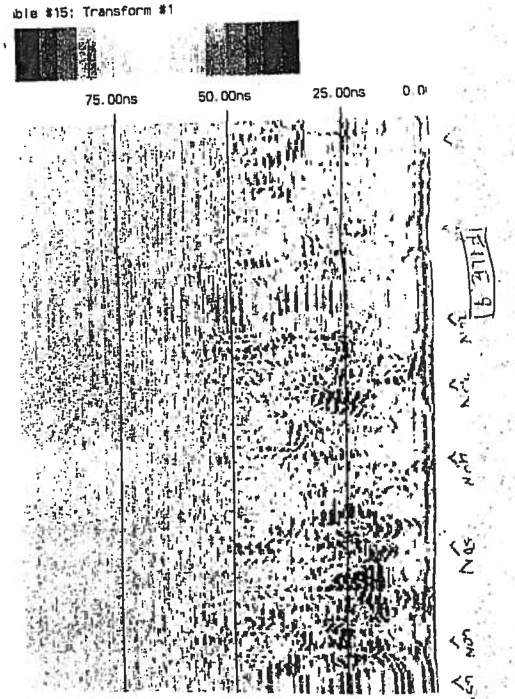
ble #15; Transform #1



FILE9(11/21/96 12:46:32) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
ielectric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

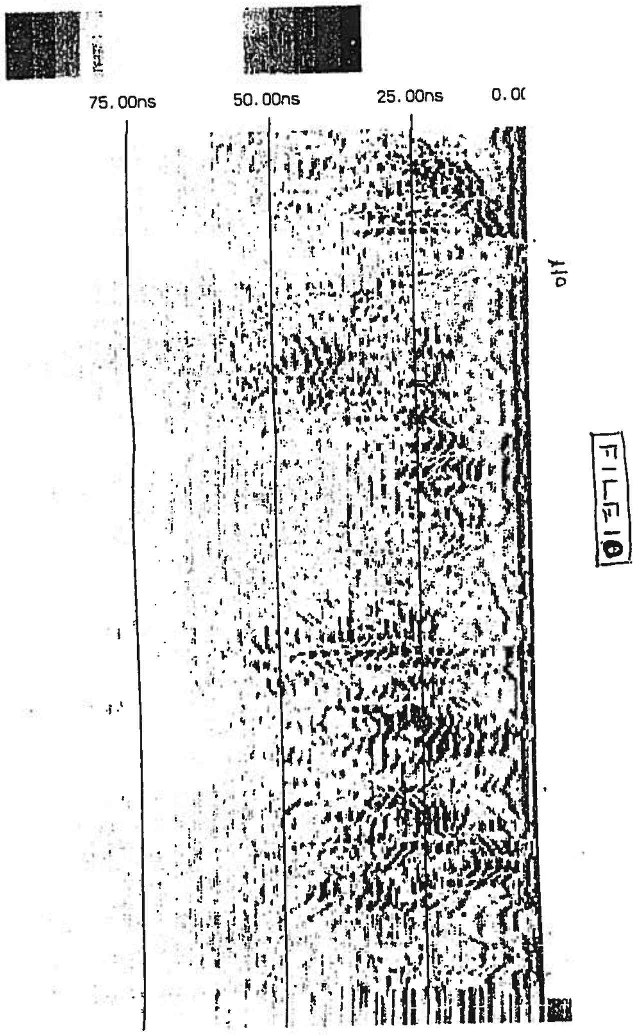
ble #15; Transform #1



_E10(11/21/96 12:49:14) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

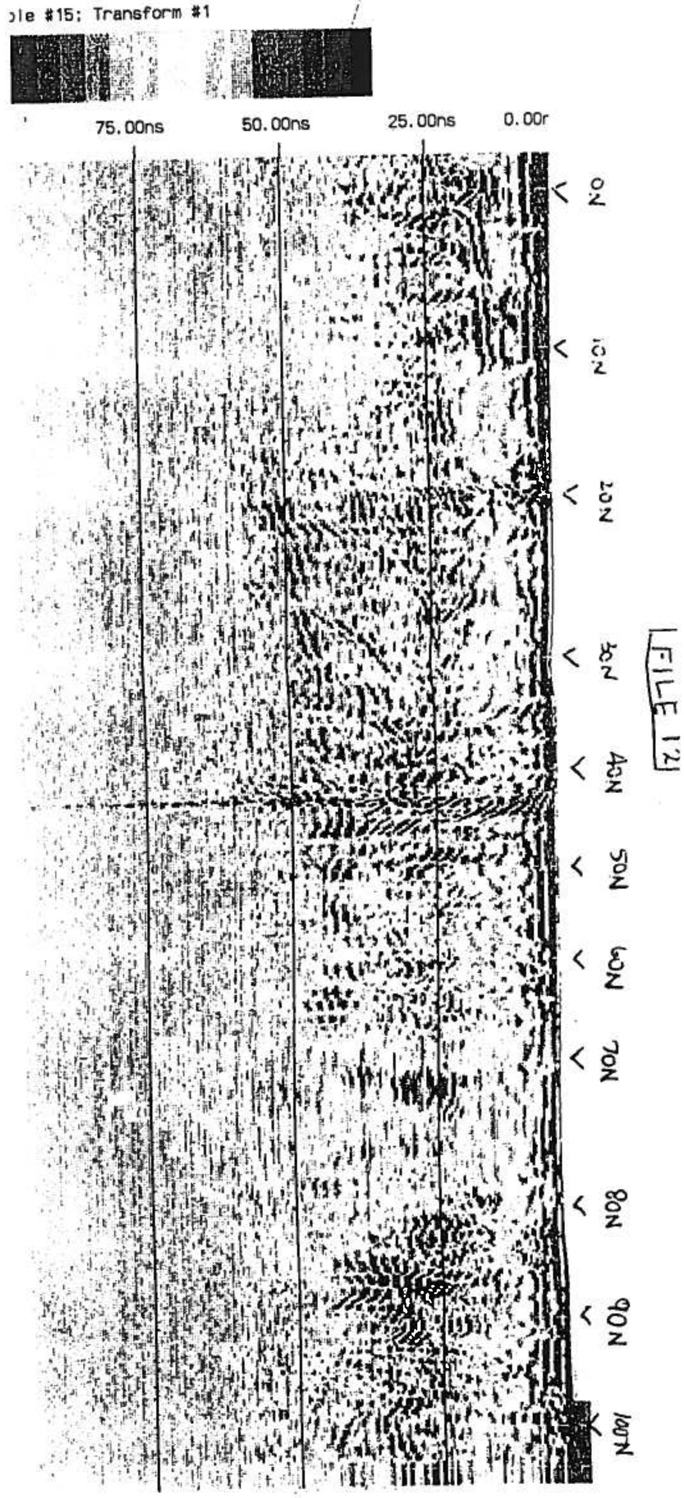
ble #15: Transform #1



Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

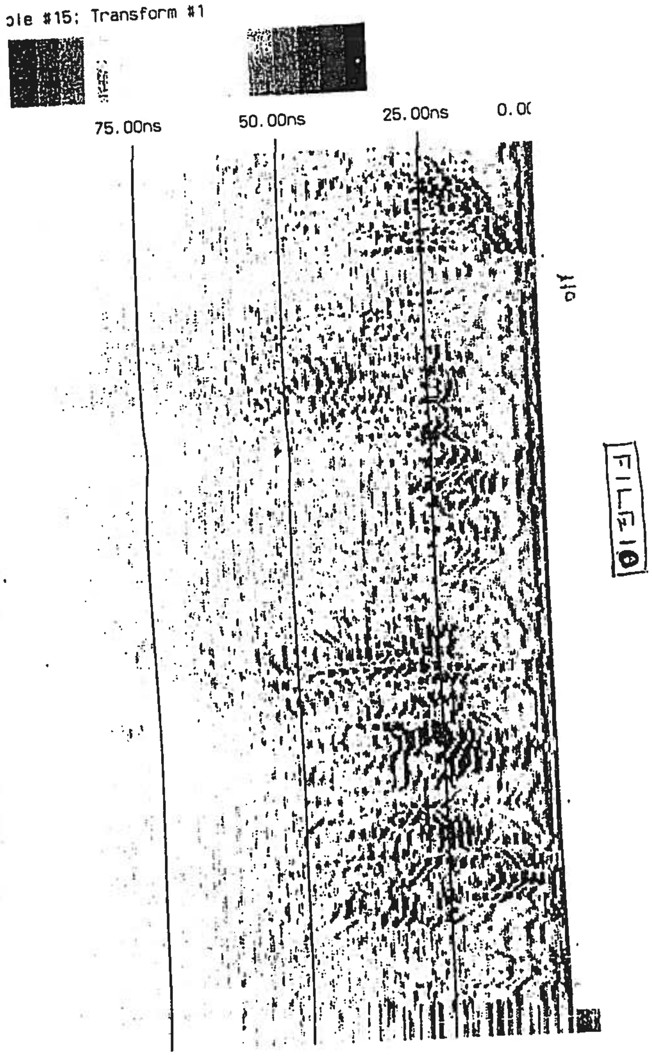
ble #15: Transform #1



_E10(11/21/96 12:49:14) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

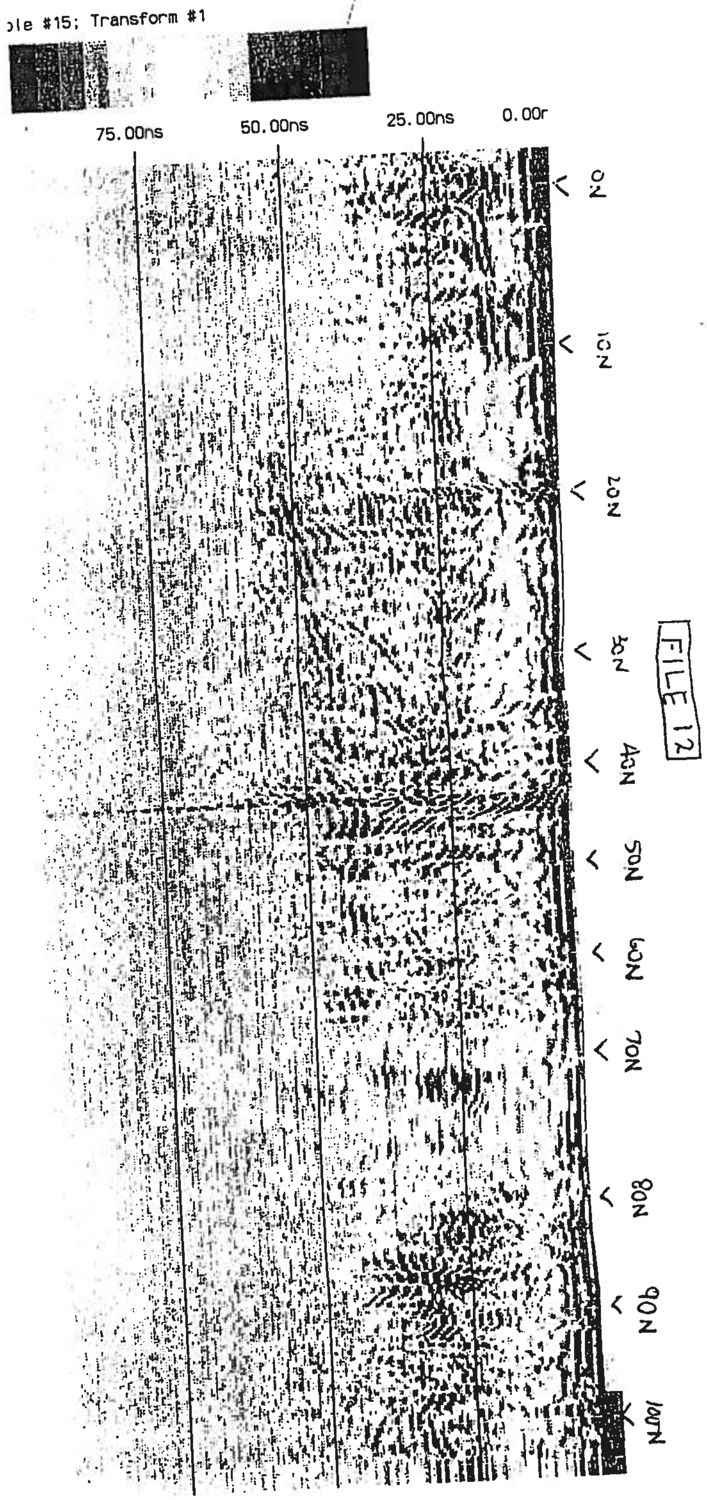
sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

ble #15; Transform #1



sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

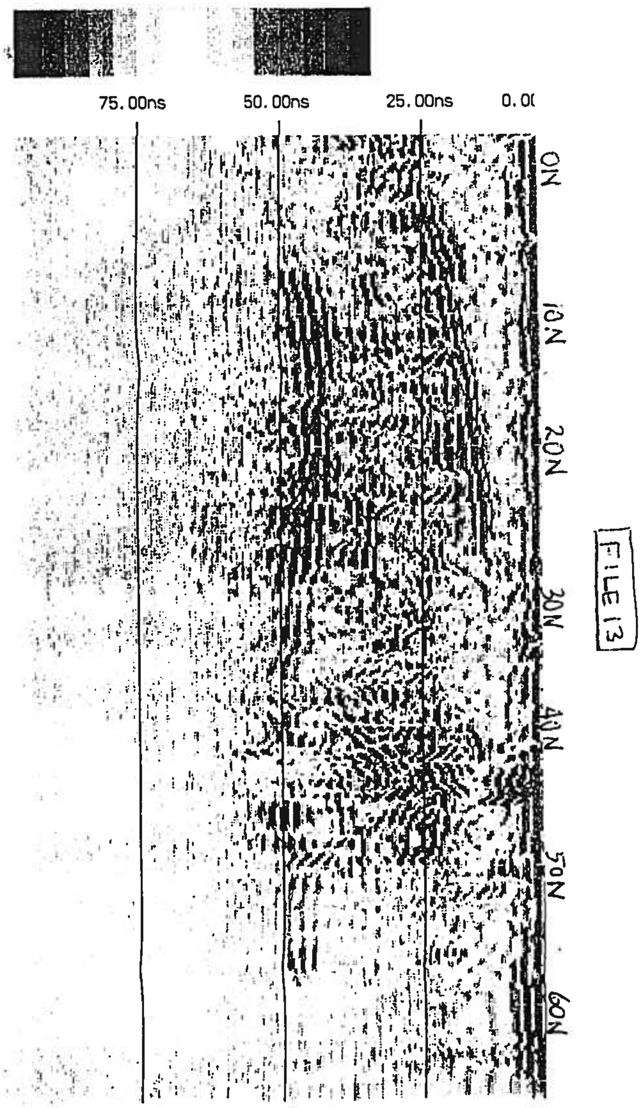
ble #15; Transform #1



FILE13(11/21/96 13:00:34) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

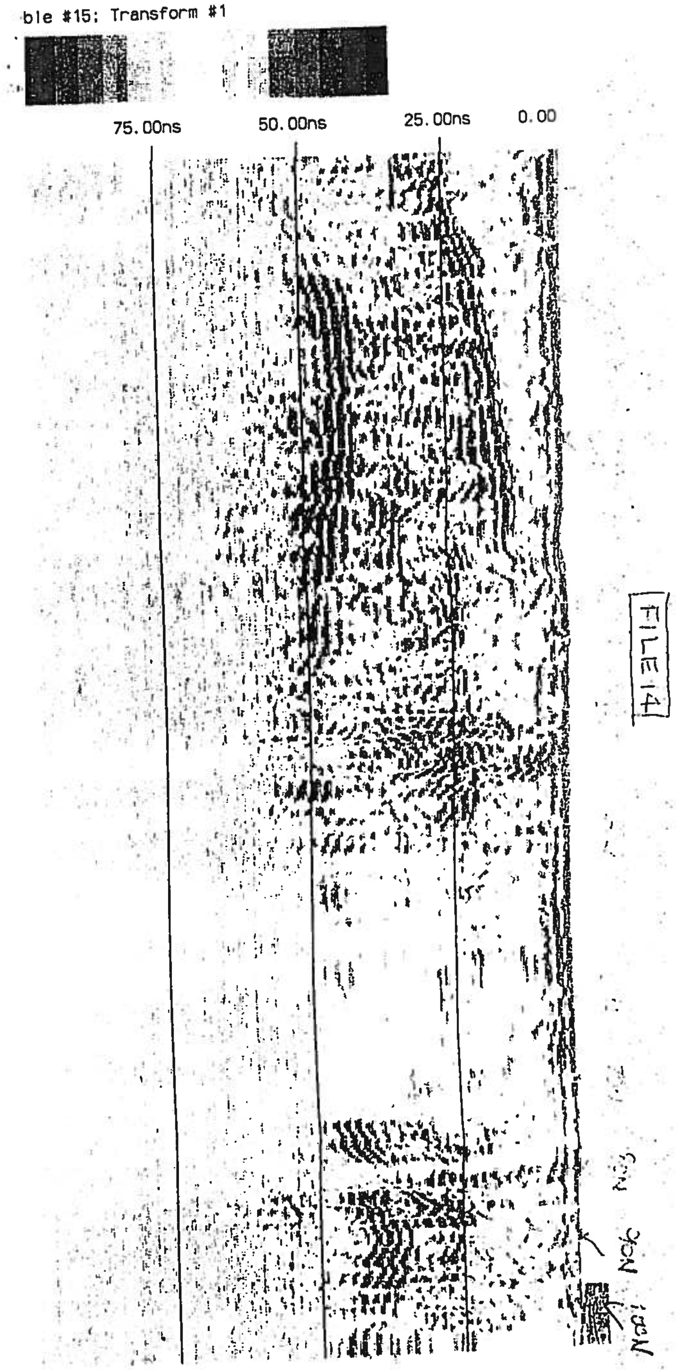
ble #15; Transform #1



FILE14(11/21/96 13:02:36) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

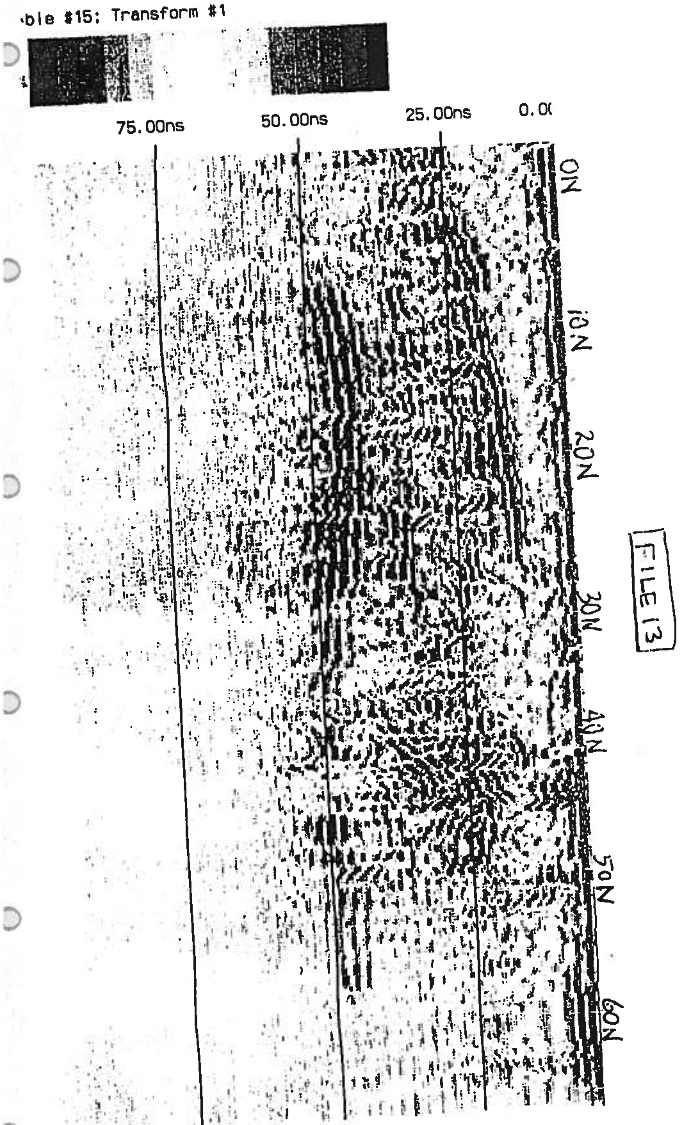
ble #15; Transform #1



ILE13(11/21/96 13:00:34) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

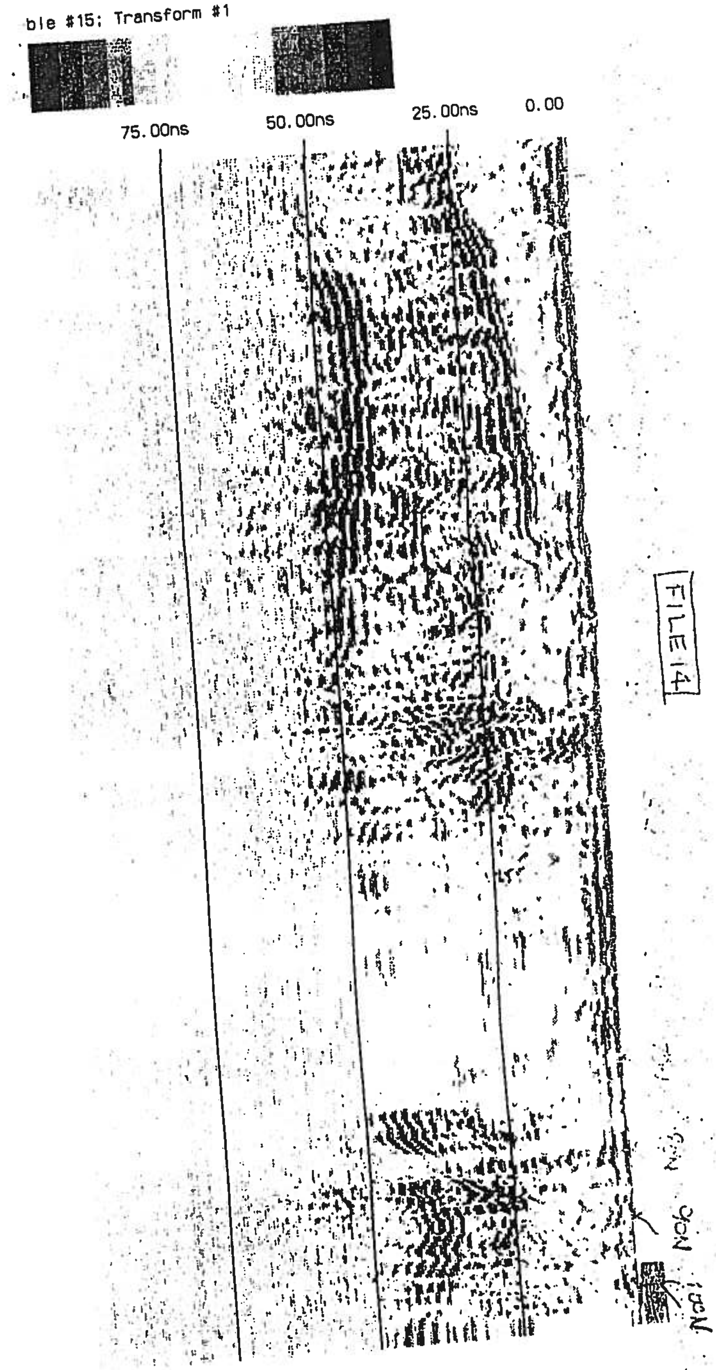
ble #15; Transform #1



Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

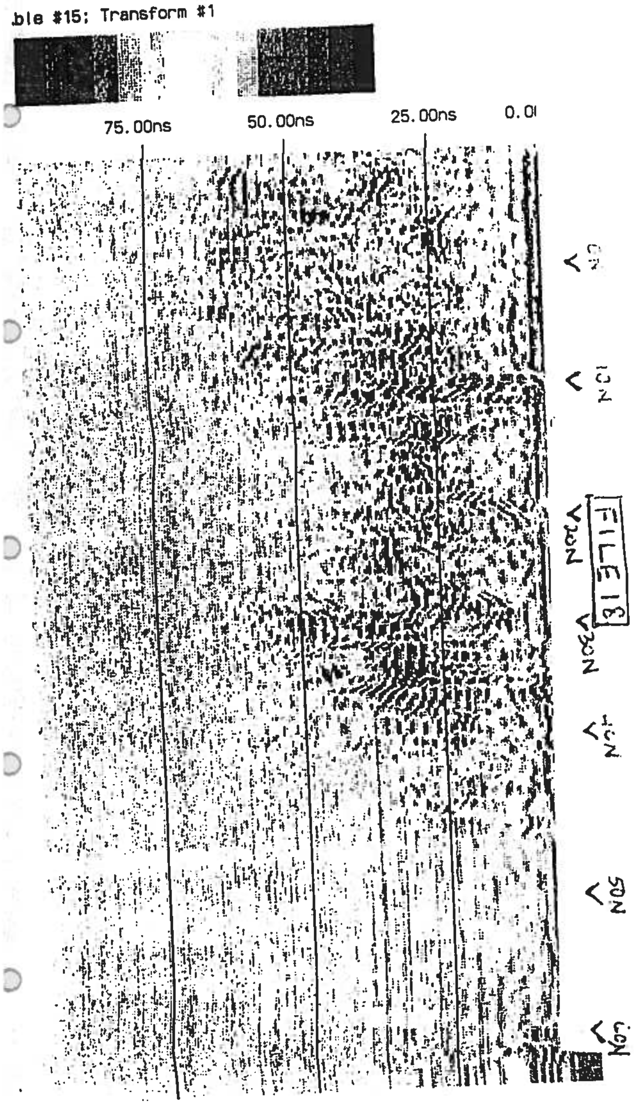
ble #15; Transform #1



_E18(11/21/96 13:06:48) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

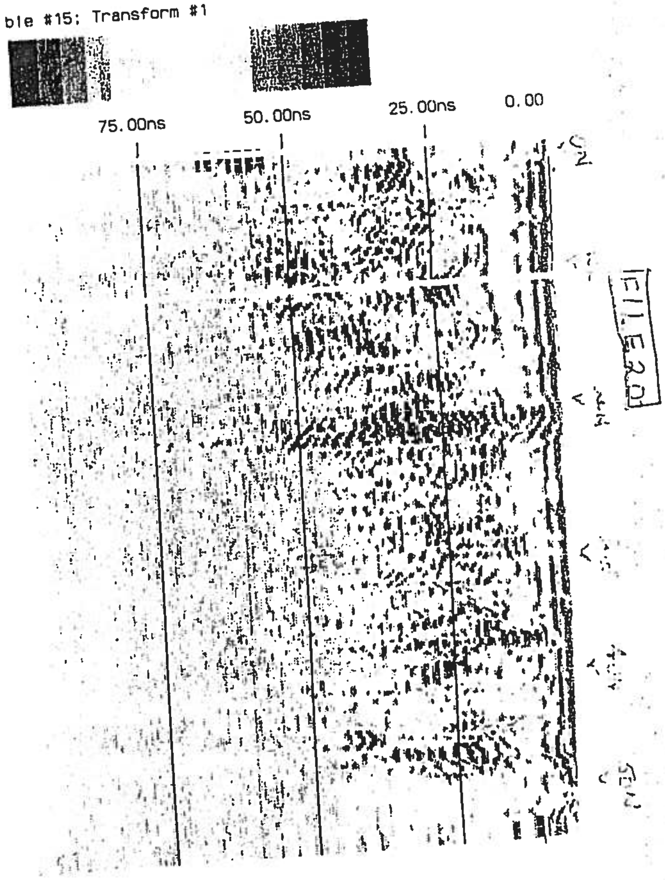
ble #15; Transform #1



FILE20(11/21/96 13:09:22) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

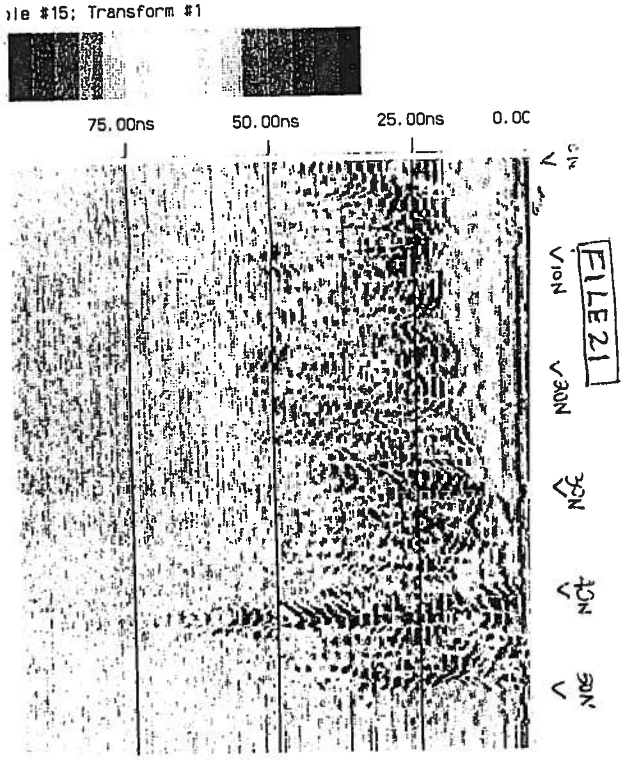
ble #15; Transform #1



FILE21(11/21/96 13:11:10) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

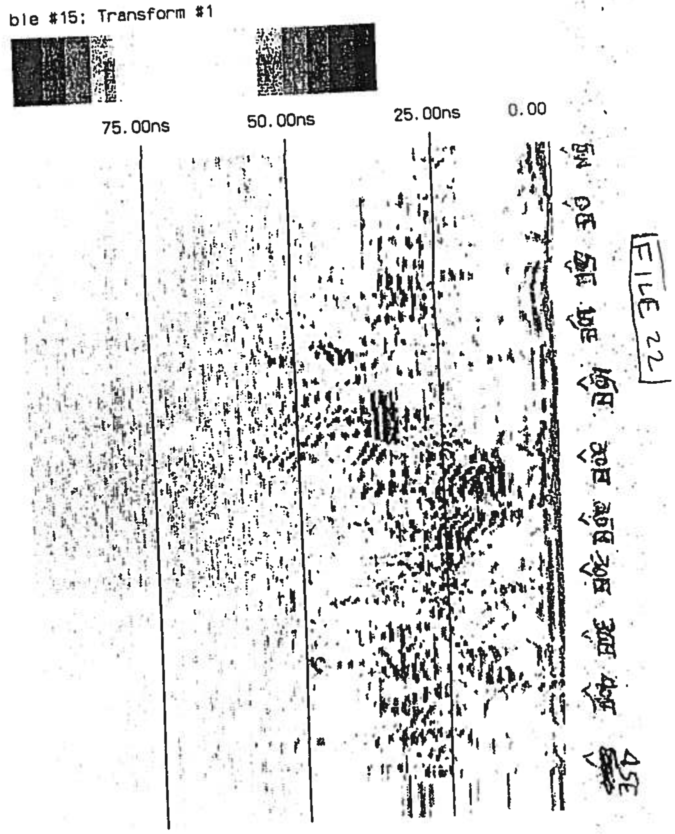
ble #15; Transform #1



FILE22(11/21/96 13:13:32) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

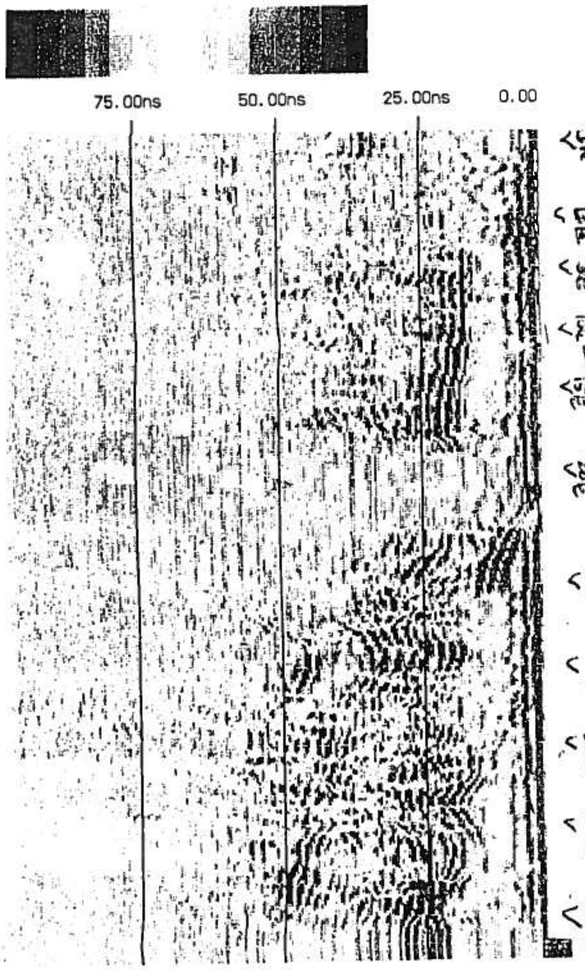
ble #15; Transform #1



FILE23(11/21/96 13:15:00) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

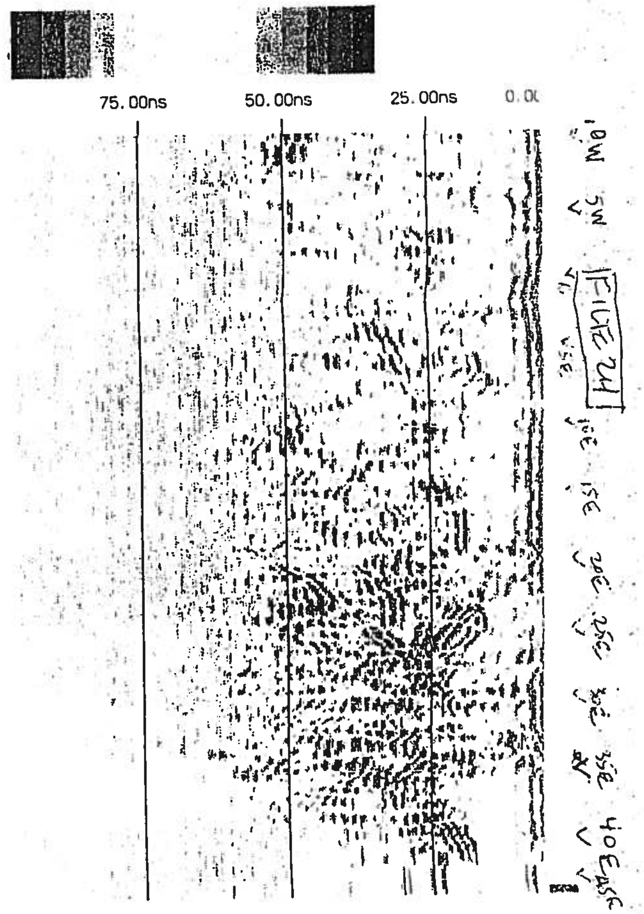
ble #15; Transform #1



LE24(11/21/96
Scan/Sec 16.0 Bits: 8
electric: 1.00

sition: 0.0nS Range: 100.0nS
nge Gain 18 40 52 52 55
IIR LP N=1 F=1078)
IIR HP N=2 F=67)
IIR STK TC=4)

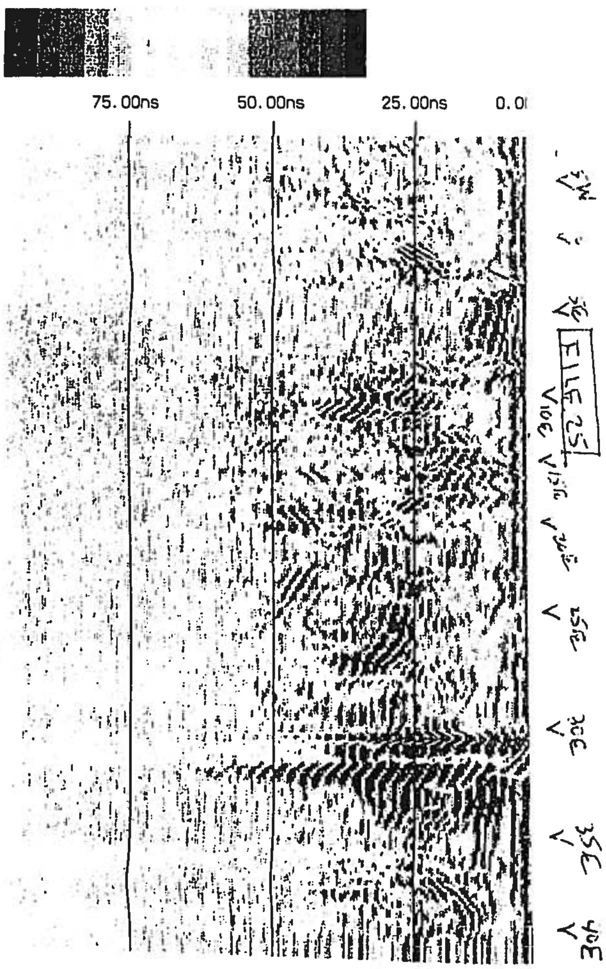
ble #15; Transform #1



FILE25(11/21/96 13:20:50) Samp/...
Scan/Sec 16.0 Bits: 8
ielectric: 1.00

osition: 0.0nS Range: 100.0nS
ange Gain 18 40 52 52 55
(IIR LP N=1 F=1078)
(IIR HP N=2 F=67)
(IIR STK TC=4)

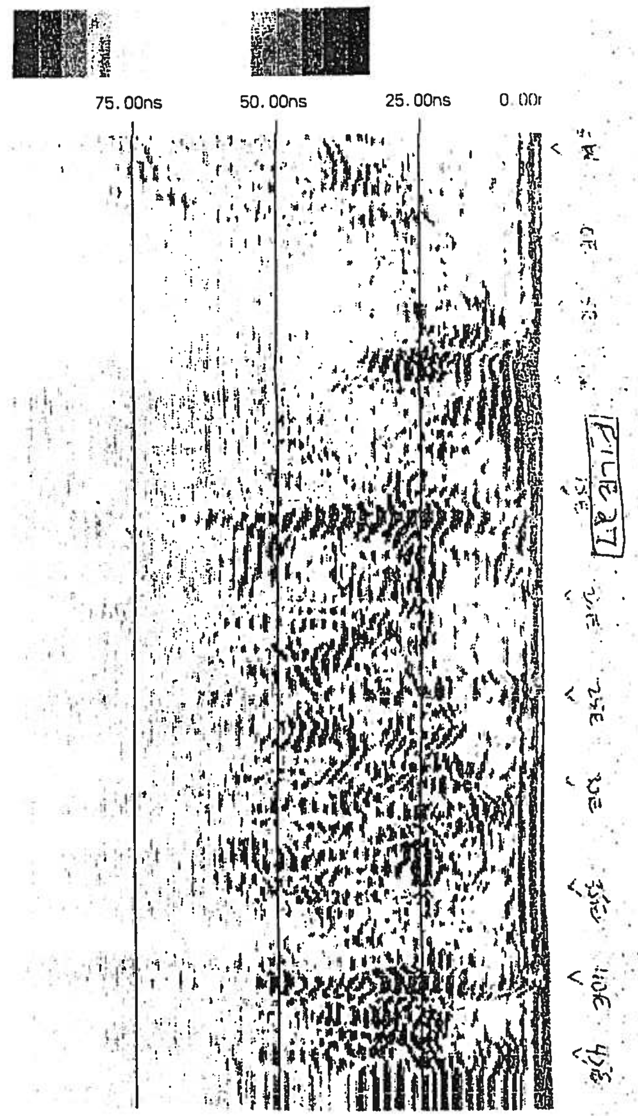
able #15; Transform #1



FILE27(11/21/96 13:24:48) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
lectric: 1.00

ition: 0.0nS Range: 100.0nS
ge Gain 18 40 52 52 55
IR LP N=1 F=1078)
IR HP N=2 F=67)
IR STK TC=4)

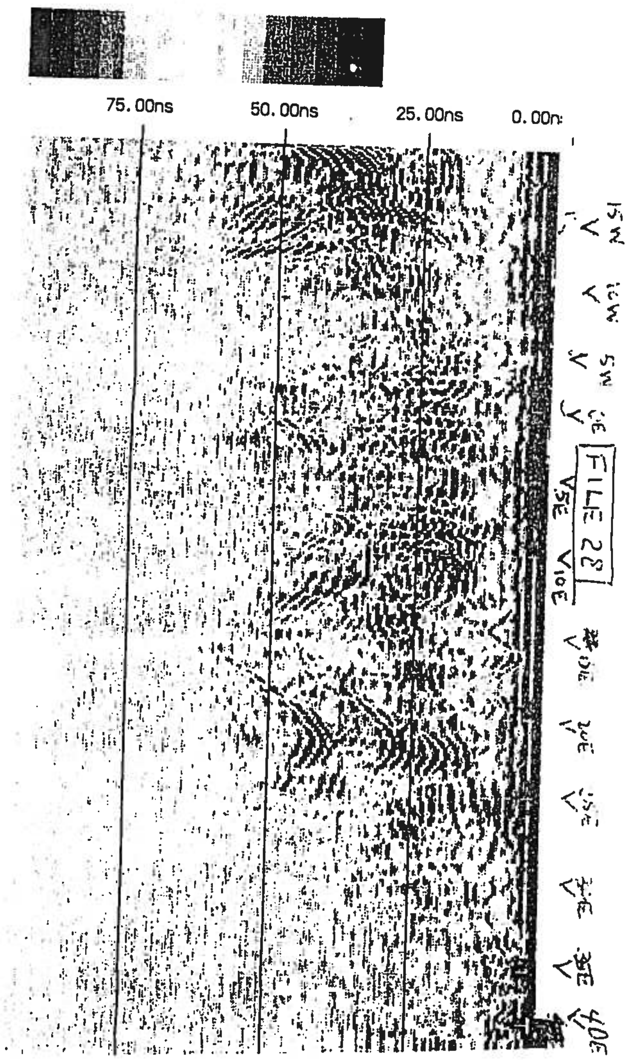
le #15; Transform #1



FILE28(11/21/96 13:27:38) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
lectric: 1.00

ition: 0.0nS Range: 100.0nS
ge Gain 18 40 52 52 55
IR LP N=1 F=1078)
IR HP N=2 F=67)
IR STK TC=4)

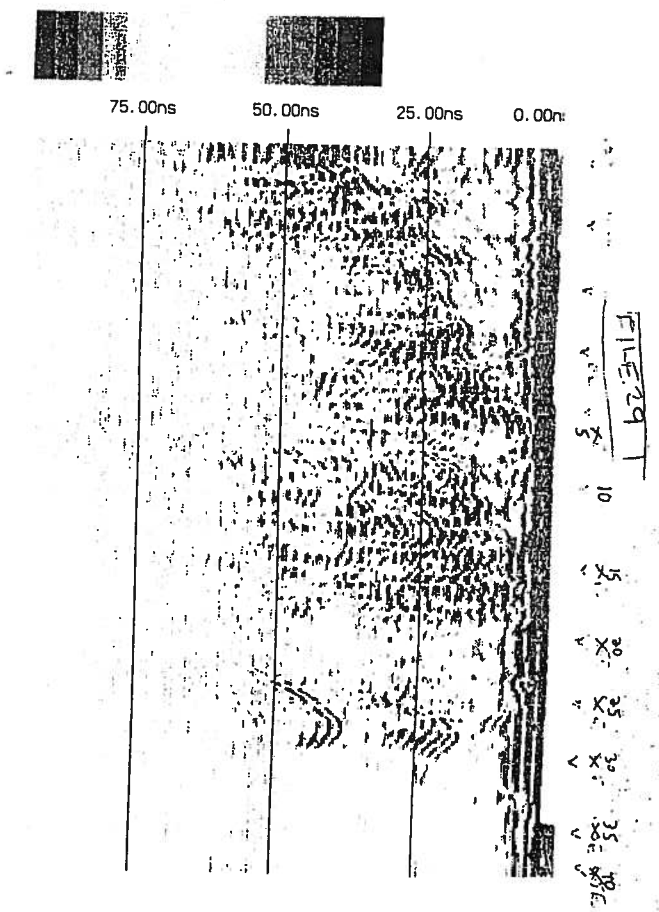
le #15; Transform #1



FILE29(11/21/96 13:30:38) Samp/Scan 1024
Scan/Sec 16.0 Bits: 8
lectric: 1.00

ition: 0.0nS Range: 100.0nS
ge Gain 18 40 52 52 55
IR LP N=1 F=1078)
IR HP N=2 F=67)
IR STK TC=4)

le #15; Transform #1



BCLP02638

BCLP02639

APPENDIX B

FIELD DATA

LOG OF BORING

PROJECT: **Magna Metals**
PROJECT NO: 1172
LOCATION: Cortlandt, New York
GEOLOGIST: M. Mazza
DRILLER: Advanced Drilling, Inc.
DRILLING/SAMPLING METHOD: Hollow Stem Auger/2" split spoons

BORING NUMBER: **MW-1**
DATE STARTED: 11/19/97
DATE COMPLETED: 11/19/97
GROUNDWATER DEPTH: approximately 14 feet bgs.
GROUND SURFACE ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (feet)	USCS CLASS.	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	OVA ppm	COMMENTS
	0								
		2			Grass, Roots, fine GRAVEL, trace				
	1	2	1.5		Sand, trace Clay, and Silt; moist.	1017	11/19/97	NAB	
		3			Brown fine SAND, and Silt, trace Clay;				
	2	9			moist.				
		34			Orange-brown fine SAND, and Silt, trace				
	3	9	1.5		Clay; moist.	1022	11/19/97	NAB	
		37							
	4	13			Brown medium to fine SAND; moist.				
		21			Brown fine SAND, trace Silt, trace				
	5	38	1.5		medium to fine subrounded Gravel; dry.	1030	11/19/97	NAB	
		30							
	6	25							
		28			Brown medium to fine SAND, trace Silt,				
MMS-MW1-01	7	33	1.5		trace fine subangular to subrounded	1035	11/19/97	NAB	
		38			Gravel; dry.				
	8	29							
		27			Brown fine SAND, trace Silt, Granitic				
	9	30	1.5		fragments (9.0 to 9.3 ft. bgs); dry.	1047	11/19/97	NAB	
		38							
	10	40							
		65			Brown fine SAND, trace Silt, and medium				
	11	100/4"	0.67		Gravel; very tight, very dense; dry.	1055	11/19/97	NAB	
		--							
	12	--							
		27			Brown medium to fine SAND, trace Silt,				
MMS-MW1-02	13	28	1.8		some medium to fine subangular Gravel;	1110	11/19/97	NAB	
		30			dry.				
	14	33							
		33			Brown fine SAND, trace Silt; wet.				
	15	100/1"	0.5			1120	11/19/97	NAB	
					End of Boring @ 14.5 feet bgs.				
	16								
	17								
	18								
	19								
	20								

NOTES:

FOSTER WHEELER ENVIRONMENTAL CORPORATION

LOG OF BORING

PROJECT: **Magna Metals**
PROJECT NO: 1172
LOCATION: Cortlandt, New York
GEOLOGIST: M. Mazza
DRILLER: Advanced Drilling, Inc.
DRILLING/SAMPLING METHOD: Hollow Stem Auger/2" split spoons

BORING NUMBER: **MW-2**
DATE STARTED: 11/18/07
DATE COMPLETED: 11/18/97
GROUNDWATER DEPTH: NA
GROUND SURFACE ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (feet)	USCS CLASS.	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	OVA ppm	COMMENTS
	0								
	1 2	3 5 4 5			Brown fine SAND, and Silt, some medium to fine subrounded Gravel; moist.	1315	11/18/97	NAB	
	3 4	4 4 3 3				1320	11/18/97	NAB	
	5 6	3 3 3 3			Brown to Orange-brown fine SAND, and Silt, trace fine subrounded Gravel; slightly moist.	1335	11/18/97	NAB	
MMS-MW2-01 MMD-MW2-01	7 8	3 5 7 12			Light Brown to Tan fine SAND, dry.	1350	11/18/97	NAB	
	9 10	10 12 17 19				1415	11/18/97	NAB	
	11 12	12 15 18 23			Brown medium ot fine SAND with mica flakes, some fine subrounded Gravel; dry.	1420	11/18/97	NAB	
MMS-MW2-02	13 14	17 25 28 40				1435	11/18/97	NAB	
	15 16	145/6" -- -- --			Granite fragment.	1450	11/18/97	NAB	
	17 18	55 135 -- --			Brown medium to fine SAND, and Silt, and medium to fine subangular to subrounded Gravel; dry.	1515	11/18/97	NAB	
	19 20	100/6" -- -- --			Brown medium to fine SAND, trace Silt, some mica flakes, and subangular to subrounded Gravel; dry.	1535	11/18/97	NAB	

NOTES:

LOG OF BORING

PROJECT: Magna Metals
PROJECT NO: 1172
LOCATION: Cortlandt, New York
GEOLOGIST: M. Mazza
DRILLER: Advanced Drilling, Inc.
DRILLING/SAMPLING METHOD: Hollow Stem Auger/2" split spoons

BORING NUMBER: MW-2
DATE STARTED: 11/18/97
DATE COMPLETED: 11/18/97
GROUNDWATER DEPTH: NA
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (feet)	USCS CLASS.	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	OVA ppm	COMMENTS
	20								
	21	100/4"	0.25		Medium to fine subrounded GRAVEL, and Brown medium to fine Sand, and Silt; dry, abundant mica flakes.	1600	11/18/97	NAB	Auger refusal @ 22 feet bgs.
	22								
	23				End of boring @ 22 feet bgs.				
	24								
	25								
	26								
	27								
	28								
	29								
	30								
	31								
	32								
	33								
	34								
	35								
	36								
	37								
	38								
	39								
	40								

NOTES:NAB=not above background.

PAGE 2 OF

LOG OF BORING

PROJECT: Magna Metals
PROJECT NO: 1172
LOCATION: Cortlandt, New York
GEOLOGIST: M. Mazza
DRILLER: Advanced Drilling, Inc.
DRILLING/SAMPLING METHOD: Hollow Stem Auger/2" split spoons

BORING NUMBER: **MW-3**
DATE STARTED: 11/17/97
DATE COMPLETED: 11/17/97
GROUNDWATER DEPTH: NA
GROUND SURFACE ELEVATION:

SAMPLE ID	DEPTH (feet) 0	BLOWS per 6"	RECOVERY (feet)	USCS CLASS.	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	OVA ppm	COMMENTS
	1 2	4 10 12 18	1.3		Brown fine SAND, and Silt; dry.	1105	11/17/97	NAB	
	3 4	8 9 10 10	1.3		Brown medium to fine SAND, trace Silt, trace fine subrounded Gravel; dry.	1110	11/17/97	NAB	
	5 6	3 2 3 4	1.0		Brown fine SAND, trace fine subrounded Gravel; dry.	1120	11/17/97	NAB	
MMS-MW3-01	7 8	5 9 27 35	1.5		Light Brown to Tan fine SAND, trace fine subrounded Gravel; dry.	1125	11/17/97	NAB	
	9 10	21 32 40 48	2.0		Light Brown to Tan fine SAND, some medium to fine subangular Gravel; dry. Dark Brown medium to fine SAND; dry. SAME as 8.0 to 9.0 ft. bgs interval.	1135	11/17/97	NAB	
	11 12	75 100/.4 -- --	0.83		Light Brown to Tan fine SAND, trace subangular to subrounded Gravel; dry.	1140	11/17/97	NAB	
	13 14	15 19 20 24	1.25		Light Brown to Tan fine SAND, trace subrounded Gravel; dry. Medium subangular GRAVEL; dry.	1200	11/17/97	NAB	
	15	37 100/3"	0.25		Light Brown to Tan fine SAND, and medium to fine subangular Gravel; dry.	1214	11/17/97	NAB	
	16				End of boring @ 14.8 feet bgs				
	17							NAB	
	18								
	19							NAB	
	20								

NOTES:

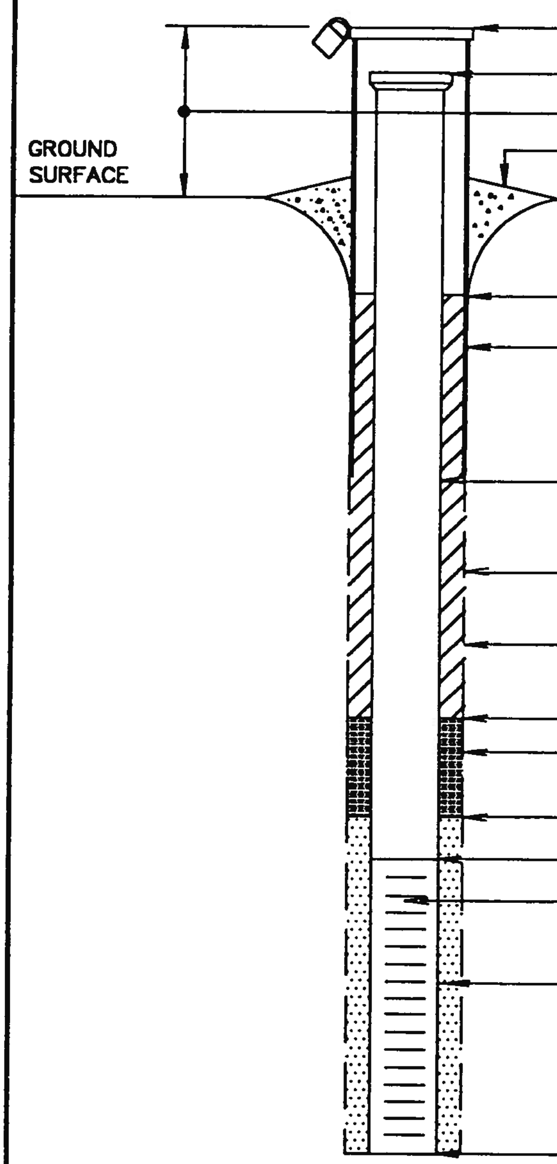
FOSTER WHEELER ENVIRONMENTAL CORPORATION

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO. MW-1

PROJECT: MAGNA METALS
PROJECT NO.: 1172
ELEVATION:
DATE: 11-18-97
FIELD GEOLOGIST: M. MAZZA

DRILLER: ADVANCED DRILLING INC.
DRILLING METHOD: HOLLOW STEM AUGER (HSA)
DEVELOPMENT METHOD:



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
TYPE OF SURFACE SEAL: CONCRETE
GROUND SURFACE ELEVATION:

DEPTH TO BACKFILL: 0.4' 0

I.D. OF SURFACE CASING: 8 INCH
TYPE OF SURFACE CASING: STEEL

RISER PIPE I.D. 2 INCH
TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 8 1/4"

TYPE OF BACKFILL: BENTONITE/CEMENT SLURRY

DEPTH TOP OF SEAL: 2.5' bgs
TYPE OF SEAL: HYDRATED BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 3.5' bgs
DEPTH TOP OF SCREEN: 4.5' bgs
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE X LENGTH: .010 INCH x 10 FT.
TYPE OF SAND PACK: MORIE #1

DEPTH BORING AND BOTTOM OF SCREEN: 14.5' bgs

NOT TO SCALE

CAD FILE NAME: 1MM41098.DWG DATE: 10/13/98
PLOT SCALE: TO FIT TIME: 11:11 AM

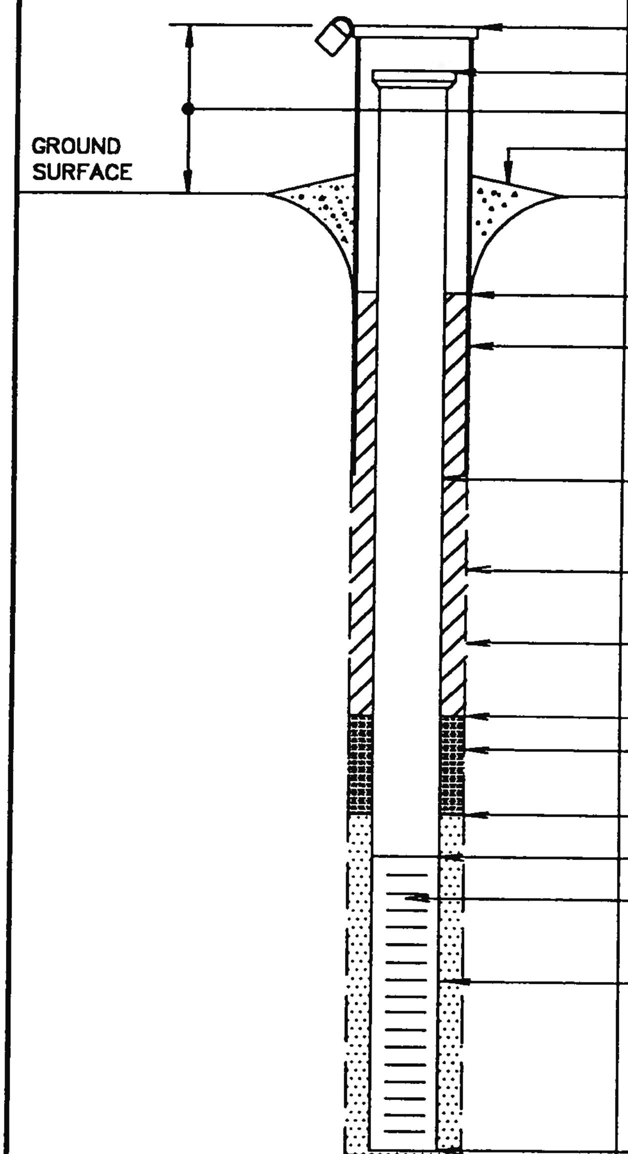
UNMW1.DWG

UNCONSOLIDATED MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO. MW-2

PROJECT: MAGNA METALS
PROJECT NO.: 1172
ELEVATION:
DATE: 11-18-97
FIELD GEOLOGIST: M. MAZZA

DRILLER: ADVANCED DRILLING INC.
DRILLING METHOD: HOLLOW STEM AUGER (HSA)
DEVELOPMENT METHOD:



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
TYPE OF SURFACE SEAL: CONCRETE
GROUND SURFACE ELEVATION:

DEPTH TO BACKFILL: 0.4'
I.D. OF SURFACE CASING: 8 INCH
TYPE OF SURFACE CASING: STEEL

RISER PIPE I.D. 2 INCH
TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 8 1/4"

TYPE OF BACKFILL: BENTONITE/CEMENT SLURRY

DEPTH TOP OF SEAL: 8' bgs
TYPE OF SEAL: HYDRATED BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 10' bgs
DEPTH TOP OF SCREEN: 12' bgs
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE X LENGTH: .010 INCH x 10 FT.
TYPE OF SAND PACK: MORIE #1

DEPTH BORING AND BOTTOM OF SCREEN: 22' bgs

NOT TO SCALE

CAD FILE NAME: 2MM4098.DWG DATE: 10/13/98
PLOT SCALE: TO FIT TIME: 11:12 AM

UNMW1.DWG

LOG OF BORING

PROJECT: Lightron/Magna Metals
PROJECT NO: 1172.0001.0000.0002
LOCATION: 2 Feet west of Pit A
GEOLOGIST: Donald Campbell
DRILLER: Gerard Mallack/Advanced Drilling
DRILLING/SAMPLING METHOD: 2" split spoon driven by 140lb hammer dropped 30 inches. Tripod Rig.

BORING NUMBER: SB-01
DATE STARTED: 12-10-96
DATE COMPLETED: 12-10-96
GROUND WATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0						
	0.5	5-9		0.5 Topsoil			OVA: NAB
	1			Brown f SAND, little Silt, trace f Gravel. FILL	1100	12-10-96	
	1.5	13-11					
	2						
	2.5	9-7					OVA: NAB
	3				1110	12-10-96	
	3.5	8-7					
	4						
MMS-SB01-01	4.5	3-5					4.0-5.5, OVA: NAB
	5				1120	12-10-96	
	5.5	17-22		5.5			5.5-6.0, OVA
	6			Brown cmf SAND with gold and green grains, angular FILL			
	6.5	41-49					OVA: NAB
	7				1130	12-10-96	
	7.5	32-30					
	8						
	8.5			END OF BORING			
	9						
	9.5						
	10						
	10.5						
	11						
	11.5						
	12						
	12.5						
	13						
	13.5						
	14						
	14.5						
	15						

NOTES: OVA: Organic Vapor Analyzer
NAB: Not Above Background
Pit A: 4 Feet Deep. Target Sampling Depth 4 feet to 6 feet.

LOG OF BORING

PROJECT: Lightron/Magna Metals
PROJECT NO: 1172.0001.0000.00002
LOCATION: 2 Feet west of Pit B
GEOLOGIST: Donald Campbell
DRILLER: Gerard Mallack/Advanced Drilling
DRILLING/SAMPLING METHOD: 2" Split Spoon driven by 140 lb hammer dropped 30 inches. Tripod Rig

BORING NUMBER: SB-02
DATE STARTED: 12-10-96
DATE COMPLETED: 12-10-96
GROUND WATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0						
	0.5	5 - 6	12	0.5 Topsoil	1200	12-10-96	OVA: NAB
	1			Brown mf SAND, trace Silt, trace f Gravel FILL			
	1.5	9 - 18					
	2						
	2.5	9 - 8	2	Pushed Stone	1205	12-10-96	
	3						
	3.5	6 - 6					
	4						
	4.5	9 - 10	0	No Recovery	1210	12-10-96	
	5						
	5.5	11 - 10					
	6						
	6.5	9 - 13	0		1215	12-10-96	
	7						
	7.5	13 - 16					
	8						
MMS-SB02-01	8.5	30 - 48	19	Brown f SAND, little Clay moist FILL	1225	12-10-96	OVA: NAB
	9						
	9.5	49 - 51					
	10						
	10.5			END OF BORING			
	11						
	11.5						
	12						
	12.5						
	13						
	13.5						
	14						
	14.5						
	15						

NOTES: OVA: Organic Vapor Analyzer
NAB: Not Above Background
Pit B: 8 feet deep. Target Sampling Depth 8 feet to 10 feet deep.

LOG OF BORING

PROJECT: Lightron / Magna Metals
PROJECT NO: 1172.0001.0000.0002
LOCATION: 2 feet west of Pit C
GEOLOGIST: Donald Campbell
DRILLER: Gerard Maliack/Advanced Drilling
DRILLING/SAMPLING METHOD: 2" Split Spoon driven by 140 lb hammer dropped 30 inches. Tripod Rig

BORING NUMBER: SB-03
DATE STARTED: 12-10-96
DATE COMPLETED: 12-10-96
GROUND WATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet) 0	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0.5	3-6	17	0.2 Topsoil	1330	12-10-96	OVA: NAB
	1			Brown-grey f SAND, trace silt, trace Clay			
	1.5	8-10					
	2						
	2.5	9-6	9	FILL	1340	12-10-96	2.0' to 3.5' OVA: NAB
	3						
	3.5	9-11		3.5			
	4			Black and white organic rich SILT FILL			3.5'-4.0' OVA: 3ppm
	4.5	10-8	14	Light red Brown grading to Ash Grey f SAND, little Silt, Dry, well sorted, well drained	1350	12-10-96	OVA: NAB
	5						
	5.5	12-16					
	6						
	6.5	12-19	24	FILL	1355	12-10-96	OVA: NAB
	7						
	7.5	23-39					
	8						
MMS-SB03-01	8.5	27-50	14		1400	12-10-96	OVA: 3ppm
	9	49/6"					
	9.5						
	10			END OF BORING			
	10.5			REFUSAL AT 9.5 FEET			
	11						
	11.5						
	12						
	12.5						
	13						
	13.5						
	14						
	14.5						
	15						

NOTES: OVA: Organic Vapor Analyzer
NAB: Not Above Background
Pit C: 8.5 feet deep. Target sampling depth was 8.5 to 10.5 feet, however sample was taken from 8.0' to 9.5 feet due to refusal of boring.

LOG OF BORING

PROJECT: Lightron / Magna Metals
PROJECT NO: 1172.0001.0060.00002
LOCATION: 2 feet west of Pit D
GEOLOGIST: Donald Campbell
DRILLER: Gerard Mallack / Advanced Drilling
DRILLING/SAMPLING METHOD: 2" split Spoon and 140 lb hammer dropped 30 inches. Tripod Rig

BORING NUMBER: SB-04
DATE STARTED: 12-10-96
DATE COMPLETED: 12-10-96
GROUND WATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet) 0	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0.5	6-9	22	0.2' TopSoil	1440	12-10-96	OVA: NAB
	1			Brown f SAND, little Silt,			
	1.5	32-18		little Clay, dry FILL			
	2			trace cm gravel, mediumdense			
	2.5	12-23	17		1445	12-10-96	OVA: 0.5 ppm
	3			grading to			
	3.5	14-12					
	4						
	4.5	13-12	16		1450	12-10-96	OVA: NAB
	5						
	5.5	19-16		Lt. Grey f SAND, little Silt,			
	6			well sorted, loose, dry			
	6.5	23-18	6		1455	12-10-96	OVA: 1.5 ppm
MMS-SB04-01	7						
	7.5	23-46	12	FILL	1520	12-10-96	OVA: NAB
	8	100/6					
	8.5						
	9			END OF BORING			
	9.5			REFUSAL AT 8.5 FEET			
	10						
	10.5						
	11						
	11.5						
	12						
	12.5						
	13						
	13.5						
	14						
	14.5						
	15						

NOTES: OVA: organic vapor analyzer
NAB: Not Above Background
Pit D: 7 feet Deep.
Target Sampling depth was 7 to 9 feet, but sample was taken from 6.5' to 8.5' because of refusal.

LOG OF BORING

PROJECT: Lightron/Magna Metals
PROJECT NO: 1172.0001.0000.00002
LOCATION: 2 feet west of Pit E.
GEOLOGIST: Donald Campbell
DRILLER: Gerrord Mallack/Advanced Drilling
DRILLING/SAMPLING METHOD: 2" split spoons driven by 140 lb hammer dropped 30 inches. Tripod Rig

BORING NUMBER: SB-05
DATE STARTED: 12-11-96
DATE COMPLETED: 12-11-96
GROUND WATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet) 0	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0.5	2-4	9	0.4 TopSoil			
	1			Brown mf SAND, little silt, trace clay trace f. Gravel medium dense	0900	12-11-96	OVA: NAB
	1.5	4-6					
	2						
	2.5	3-6	11				
	3						
	3.5	16-23		FILL	0905	12-11-96	OVA: NAB
	4			grading to			
	4.5	23-31	15				
MMS-SB05-01	5			Light Grey f SAND, little silt, dry, medium dense	0915	12-11-96	OVA: NAB
	5.5	36-49					
	6						
	6.5	100/6	2	FILL	0920	12-11-96	OVA: 1ppm
	7			END OF BORING			
	7.5			REFUSAL AT 6.5 FEET			
	8						
	8.5						
	9						
	9.5						
	10						
	10.5						
	11						
	11.5						
	12						
	12.5						
	13						
	13.5						
	14						
	14.5						
	15						

NOTES: OVA: Organic Vapor Analyzer
NAB: Not Above background.
Pit E: 6 feet deep.
Target Sampling Depth was 6 feet to 8 feet, however sample taken at 4.5 feet to 6.5 feet due to refusal.

LOG OF BORING

PROJECT: Lightron / Magna Metals
PROJECT NO: 1172-0001-0000-00002
LOCATION: 2 Feet West of Pit F
GEOLOGIST: Donald Campbell
DRILLER: Gerrard Mallack/Advanced Drilling
DRILLING/SAMPLING METHOD: 3" Split Spoon (driven by 140 lb hammer dropped 30 inches. Tripod Rig

BORING NUMBER: SB-06
DATE STARTED: 12-11-96
DATE COMPLETED: 12-11-96
GROUND WATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0						
	0.5			0.5 Topsoil			
	1–2	3-4 6-6	17	Brown mf SAND, little Silt, trace Clay, medium dense dry	1010	12-11-96	OVA: NAB
	2.5–4	4-4 15-16	11	FILL	1020	12-11-96	OVA: NAB
	4.5–6	14-18 15-16	0		1030	12-11-96	Pushed Stone
	6.5–8	19-23 23-25	7	Grey-brown mf SAND, little Silt, trace Clay, little	1050	12-11-96	OVA: NAB
MMS-SB06-01	8.5–9.5	48-61 100/6"	5	C Gravel, medium dense, moist FILL	1110	12-11-96	OVA: 1 ppm
	10–15			END OF BORING REFUSAL AT 9.5 FEET			

NOTES: OVA: Organic Vapor Analyzer
NAB: Not Above Back
Pit F: 7.5 feet deep. Target Sampling Depth: 7.5 to 8.5 feet.

LOG OF BORING

PROJECT: Lightron/Magna Metals
PROJECT NO: 1172.0001.0600.00002
LOCATION: 2 feet west of Pit G
GEOLOGIST: Donald Campbell
DRILLER: Gerrard Mallack
DRILLING/SAMPLING METHOD: 3" split spoon driven by 140 lb hammer dropped 30 inches. Tripod Rig.

BORING NUMBER: SB-07
DATE STARTED: 12-11-96
DATE COMPLETED: 12-11-96
GROUND WATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0						
	0.5	3-4	14	Brown mf SAND, little Silt. Organic Rich Roots., loose, dry	1235	12-11-96	OVA: NAB
	1						
	1.5	7-8					
	2						
	2.5	19-19	6	FILL	1245	12-11-96	OVA: NAB
	3						
	3.5	12					
MMS-SB07-01	4	14-10	17	4.0 Black to Brown mf SAND, little Silt Black bituminous Sand sized 5.0 Particles FILL	1300	12-11-96	OVA: 1ppm
MMD-SB07-01	4.5						
	5						
	5.5	10-14					
	6			5.5 Lt. Grey f SAND, little Silt, dry, loose FILL			
	6.5			END OF BORING 5.5 FEET			
	7						
	7.5						
	8						
	8.5						
	9						
	9.5						
	10						
	10.5						
	11						
	11.5						
	12						
	12.5						
	13						
	13.5						
	14						
	14.5						
	15						

NOTES: OVA: Organic Vapor Analyzer
NAB: Not Above Background
Pit G: 3.5 Feet Deep. Target Sampling Depth: 3.5' to 5.5'.

LOG OF BORING

PROJECT: Magna Metals
PROJECT NO: 1172.0001.0000.00001
LOCATION: Cortlandt, NY
GEOLOGIST: Donald Campbell
DRILLER: Jerry Malack/Advanced Drilling
DRILLING/SAMPLING METHOD: 2" split spoons

BORING NUMBER: SB05
DATE STARTED: 12-11-96
DATE COMPLETED: 12-11-96
GROUNDWATER DEPTH: Not Encountered
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY	PROFILE	USCS CLASS	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	HNu/OVA ppm	COMMENTS
	0–2	2, 4, 4, 6	9"			0"-4" topsoil; 4" to 9" Brown mf SAND, little silt & clay	0900	12-11-96	NAB	
	2–4	3, 6, 16, 23	11"		SP	Brown mf SAND, little silt and clay, trace gneissic gravel, med dense	0905	12-11-96		
					SP	3.5 Grey and black mf SAND, angular, little silt, little gravel, loose 4.5	0915	12-11-96		
MMS-SB05-01	4–6	23, 31, 36, 49	15"		SP	Light Grey f SAND, little * silt, med dense, dry	0920	12-11-96	1ppm	
	6–6.5	100	2"		SP	Rock Fragments Refusal				

END of BORING

white, course grained granitic appearance bedrock with black discoloration.

NOTES: * appears in SB03 & SB04

PAGE 1 OF

FOSTER WHEELER ENVIRONMENTAL CORPORATION

BCLP02654

LOG OF BORING

PROJECT:

PROJECT NO:

LOCATION:

GEOLOGIST:

DRILLER:

DRILLING/SAMPLING METHOD: 3" split Spoon 140lb Hammer

BORING NUMBER: SB-06

DATE STARTED: 12-11-96

DATE COMPLETED:

GROUND WATER DEPTH:

ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	COMMENTS
	0						
	0.5	3		0.0' to 0.6' Topsoil			
	1	4	17"	0.6' to Brown mf SAND, little	1010	12-11-96	
	1.5	6		silt and clay, med dense, dry			
	2	6					
	2.5	4					
	3	4	11"		1020	12-11-96	
	3.5	15					
	4	16					
	4.5	14		No Recovery			Stone pushed
	5	18	0"		1030	12-11-96	
	5.5	15					
	6	16					
	6.5	19		Grey brown mf SAND, little			
	7	23	7"	silt, trace clay, moist,	1050	12-11-96	
MHS-SB06-01	7.5	23		medium dense, little			
	8	25		coarse gravel.			
	8.5	48					
	9	61	5"		1110	12-11-96	1 PPM (OVA)
	9.5	100/6"		Refusal			
	10			End of Boring			
	10.5						
	11						
	11.5						
	12						
	12.5						
	13						
	13.5						
	14						
	14.5						
	15						

7.5

NOTES:

PAGE 1 OF

LOG OF BORING

PROJECT:
PROJECT NO:
LOCATION: 2 ft west of "Pit G"
GEOLOGIST:
DRILLER: Jerry McMack
DRILLING/SAMPLING METHOD:

BORING NUMBER: SB07
DATE STARTED:
DATE COMPLETED:
GROUNDWATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY	PROFILE	USCS CLASS	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	HNu/OVA ppm	COMMENTS
	0–2	3, 4, 7, 8	14"		SP	Brown organic rich mf SAND, little silt, roots, loose, dry	1235	12-11-96		
	2–4	19, 19, 12	6"				1245	12-11-96		
MMS & MMD-SB07-01	4–6	14, 10, 10, 14	17"		SP	Black & Brown - Brown mf SAND sit little silt, with Black mf sand sized particles bituminous appearing Lt Grey f SAND, little silt dry, loose	1300		1ppm	
						END OF BORING 5.5'				

NOTES:

PAGE 1 OF

FIGURE 3-2

LOG OF BORING

PROJECT: Magna Metals
PROJECT NO:
LOCATION: Cortlandt, NY
GEOLOGIST: D. Campbell, M Petaccia
DRILLER: —
DRILLING/SAMPLING METHOD: Soil Corer

BORING NUMBER: MMS-SS-01
DATE STARTED: 4/11/97
DATE COMPLETED: 4/11/97
GROUNDWATER DEPTH:
ELEVATION:

SAMPLE ID	DEPTH (~~feet~~ in)	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	VOA ppm	COMMENTS
	0							
MMS-SS-01 -01 and MMD-SS 01-01	1	6	6"/6"	Dk brown f. to m. SAND some Silt, little Gravel abundant organics (roots) slightly cohesive, ~~moist~~	0947	4/11/97	NAB	Semi-Voa, Pest/PCB, metals, Cyanide
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9		6"/6"				NAB	VOA
	10							
	11							
	12							
	13			Boring terminated 1 ft				
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							
	30							

NOTES:
HNu - Bkgd 0ppm
6"-12" sampled twice
2nd time, adjacent borehole

LOG OF BORING

PROJECT: Magna Metals
PROJECT NO: 1172
LOCATION: Cortlandt, New York
GEOLOGIST: M. Mazza
DRILLER: Advanced Drilling, Inc.
DRILLING/SAMPLING METHOD: 2" split spoon

BORING NUMBER: SS02
DATE STARTED: 11/17/97
DATE COMPLETED: 11/17/97
GROUNDWATER DEPTH: NA
GROUND SURFACE ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (feet)	USCS CLASS.	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	OVA ppm	COMMENTS
	0								
MMS-SS02-02	1 2	17 35 40 20	0.96		Brown fine SAND, trace Silt, trace fine subangular Gravel; dry.	1515	11/17/97	NAB	
	3 4				End of boring @ 2.0 feet bgs			NAB	
	5 6							NAB	
	7 8							NAB	
	9 10							NAB	
	11 12							NAB	
	13 14							NAB	
	15 16							NAB	
	17 18							NAB	
	19 20							NAB	

NOTES:

PAGE 1 OF 1

LOG OF BORING

PROJECT: Magna metals
PROJECT NO:
LOCATION: Cortlandt, NY
GEOLOGIST: D. Campbell, M. Potaccia
DRILLER: –
DRILLING/SAMPLING METHOD: Soil Corer

BORING NUMBER: MMS-SB02
DATE STARTED: 4/11/97
DATE COMPLETED: 4/11/97
GROUNDWATER DEPTH: N/A
ELEVATION:

SAMPLE ID	DEPTH ~~(feet)~~ in	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	VOA ppm	COMMENTS
MMS-02-01	1–6			0-2" Black Organic-rich SILT; 2"-6" Brown C. to F. SAND, little Silt, Trace gravel, abundant roots	1027	4/11/97	NAB	Semi-VOA, metals, Pest/PCB, Cyanide
	7–12					4/11/97	NAB	VOA
	13			Boring terminated @ 1 ft				
	14–30							

NOTES: 1st attempt - refusal
~~2nd - ok~~
~~Dup sample [illegible] [illegible] [illegible]~~

PAGE 1 OF

FIGURE 3-2

LOG OF BORING

PROJECT: Magna metals
PROJECT NO:
LOCATION: Cortlandt, NY
GEOLOGIST: M. Petaccia, D. Campbell
DRILLER:
DRILLING/SAMPLING METHOD: Soil Corer

BORING NUMBER: MMS-SS03
DATE STARTED: 4/11/97
DATE COMPLETED: 4/11/97
GROUNDWATER DEPTH: NE.
ELEVATION:

SAMPLE ID	DEPTH ~~(feet)~~ In	BLOWS per 6"	RECOVERY (inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	VOA ppm	COMMENTS
MMS-SS03-01 Cont ms/msd	0–6	N/A		Brown organic SILT trace vegetation dry.		4/11/97	NAB	Semi-VOA, Pest/PCB metals cyanide
	6–12			Brown f. to m. SAND some silt, trace gravel abundant roots, loose		4/11/97		VOAs
	12			Boring Terminated @ 1 ft				

NOTES:

PAGE 1 OF

FIGURE 3-2
LOG OF BORING

PROJECT: Magna Metals
PROJECT NO:
LOCATION: Cortlandt, NY
GEOLOGIST: M. Petraccia, D. Campbell
DRILLER: –
DRILLING/SAMPLING METHOD: Soil Corer

BORING NUMBER: MMS-SS04
DATE STARTED: 4/11/97
DATE COMPLETED: 4/11/97
GROUNDWATER DEPTH: N.E.
ELEVATION:

SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECOVERY (Inches)	MATERIAL DESCRIPTION	COLLECTION Time	COLLECTION Date	VOA ppm	COMMENTS
MMS-SS04-01	0–6			Dk Brown organic ~~Soil~~ SILT, roots, (Topsoil) moist		4/11/97		Semi-VOA Pest/PCB Metals Cyanide
	6–12			~~Med~~ Brown ~~Silty~~ ~~SAND~~, roots, trace mica, SILT, little f ~~SAN~~ sand, organic material (roots), little f Gravel		4/11/97		VOAs
	12			Boring terminated @ 1 ft				
				trace mica ~~and other mineral~~ ~~[illegible]~~ moist				

Depth scale: 0–30 feet.

NOTES:

PAGE 1 OF

EBASCO ENVIRONMENTAL DIVISION